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DAVIS PYRITES MINE, MASSACHUSETTS

An Unique Deposit and Some Unusual Methods of Mining

BY J. J. RUTLEDGE*

In the early '80s, the late Herbert J. Davis was in the commission business in New York. On one of his trips to Canada he got into communication with persons controlling the Albert pyrites mine at Sherbrooke. This property was subsequently purchased by him, and later sold to G. H. Nichols & Co., predecessors of the Nichols Copper Company, which has since continued to work it. In this manner Mr. Davis acquired a knowledge of pyrites mining, and had several fine specimens of pyrites ore in his New York office.

A man from Massachusetts, on mining business, observed these specimens, and remarked on their similarity to a large deposit which he had noticed in the northwestern part of Massachusetts. Mr. Davis acquired all the information possible about this property, and the next day left for Rowe, in which town the mine is situated. After considerable trouble he found some of the natives who were familiar with the deposit, and who (for a consideration) consented to show him the outcrop. This consisted of a loose boulder of float pyrites on the farm of C. C. Brown.

The existence of pyrites in this section had been known locally for 50 years, and samples had been taken by different professors and chemists, who declared it valueless. The fact that pyrites was just beginning to be used for the manufacture of sulphuric acid, in place of brimstone, rendered the discovery valuable, and Mr. Davis was quick to take advantage of it. Before leaving Massachusetts he secured options on the Brown farm, and the Jillson and Eddy farms, which gave him about 1½ miles on the strike of the vein. This was in the early spring of 1882; within three months Mr. Davis arranged with local contractors and a dozen miners to open the property, and it has since then been running day and night

During the 24 years in which the mine has been in operation the entire product has been hauled down a rough mountain road to storage sheds at Charlemont, whence it is shipped as the market demands. Heavy wagons are used in the summer and sleds in the winter. There is a fall of about 600 ft. in the four miles from Davis to Charlemont, so that very heavy loads can be taken down. All the coal and the mine supplies must be hauled up hill to the mine. It is planned to build a standard-gage railroad to the mine from Charlemont at some time in the future.

SHAFT HOUSE NO. 1

SHAFT HOUSE NO. 3 AND ORE SHED

LOCATION OF THE DAVIS MINE

The Davis mine is located in the northwestern part of Franklin county, Massachusetts, and may be said to be in or near the Berkshire hills, which are an extension of the Green mountains of Vermont. The small mining village known as Davis, which surrounds the mine, lies in Rowe township; the Vermont-Massachusetts boundary line is about five miles north of the mine, and the nearest railroad point is Charlemont on the Boston & Maine Railroad, four miles away.

PHYSIOGRAPHY AND GEOLOGY OF THE REGION

The region surrounding the Davis mine lies at an elevation of about 1300 ft. above sea level, and the country is rough and broken. The mountains have rounded summits and the valleys generally carry clear streams of water.

The deposits of iron pyrites lie in rocks thought to be of Lower Silurian age, though this does not seem to be well established, as fossils are rare and the rocks have been subjected to considerable metamorphism. Intrusions of igneous rocks are common in the vicnity of the

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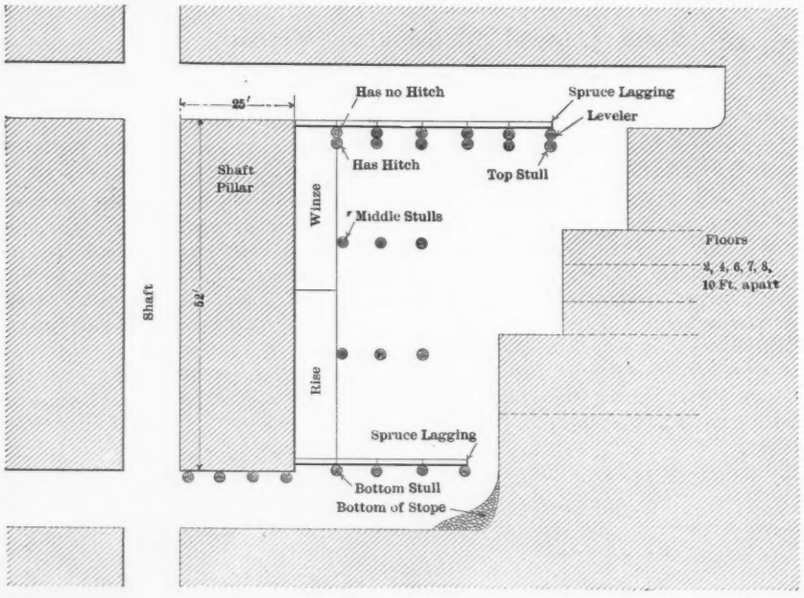
mine. Quartz veins are found cutting the country rock in many places.

Like most of the other deposits of iron pyrites in the eastern part of the United States the Davis deposit has a northeast strike of about 10 deg. and a dip to the southwest of from 70 to 80 deg. Up to the present time the deposits have been opened up along the strike for about 450 ft. and down the dip for about 1200 ft. Except a small prospect at Mt. Peake, one-fourth mile from the Boston & Maine station at Charlemont, there is no other pyrites mine in this vicinity.



UNDERHAND STOPING SYSTEM

As a rule the Davis orebody presents many of the characteristics of a true fissure vein; the orebody, or vein, thickens and then thins out again, as it is drifted upon along the strike; the orebody contains horses of country rock; the crystals of pyrite are large and well formed, and the walls show slickensides in places.

The foot wall is a mica schist; the hanging wall is a quartz schist or quartzite, which is very brittle and easily broken. At Davis, owing doubtless to the latitude of the deposits and probable recent glaciation, there is only a foot or two of the gossan, or hematite, which usually forms the iron cap of all pyrites deposits. This is in decided contrast to the pyrites deposits in Virginia, where the iron cap is often 40 to 50 ft. thick and was at one time mined for iron ore.

MINING DEVELOPMENTS

Shafts—The ore is opened up by three shafts, viz., No. 1, or main, shaft; No. 2, which has been abandoned and filled with waste rock; and No. 3, which is now producing ore. All the shafts are inclines, and follow down the dip of the ore, being sunk in the orebody at an angle of 80 deg. No. 1 shaft is down to a depth of about 1200 ft. and No. 18 level is now being opened up for production.

All the shafts are 8x12 ft., inside measurements, and have double compartments, one being used as a skipway, and the other for ladder-way, pump-way, etc.

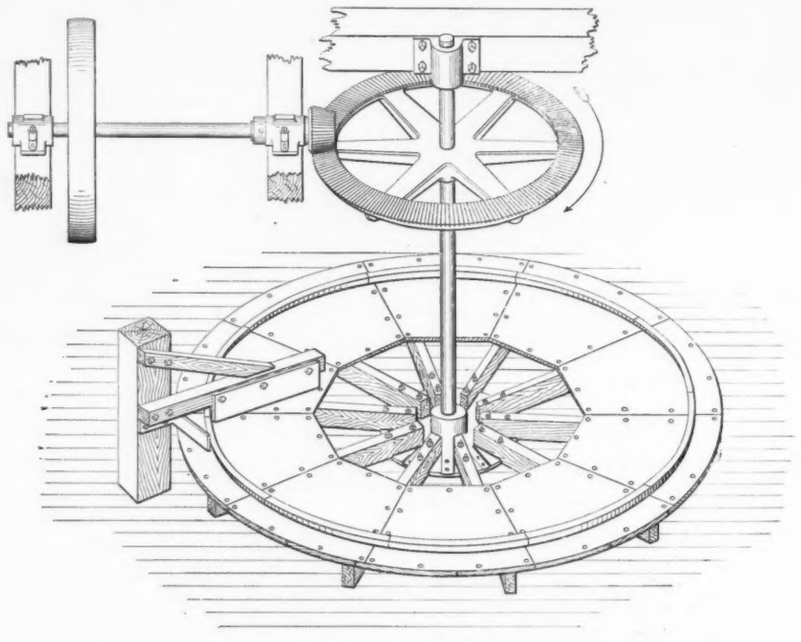
No. 3 shaft was in commission until about 1900. Its lowest level is No. 10; an ore-breaking shed, shaft house, boiler room, compressor and hoisting-engine room surround its mouth. The plant can be operated in conjunction with No. 1 plant or independently, as is desired. No. 3 shaft is neatly timbered with square shaft-sets. At No. 1 level, the ore was found to be between 30 and 40 ft. thick between walls.

Hoisting Plant—As there is only a single skip in shaft No. 1, a pair of Copeland & Bacon hoisting engines are so arranged that the empty skip can be lowered by gravity. These engines are 18-in. cylinder, 36-in. stroke, have link motion, a drum 6 ft. diameter, are second motion, and have an arrangement by means of which they can be thrown out of gear and the empty rope reeled off very carefully. In such a steep and deep shaft as No. 1 this style of hoisting arrangement is to be commended, as it reduces to a minimum the danger of accidents resulting from hoisting or lowering men and timbers. However, the speed of hoisting is rather slow, the time necessary to raise a loaded skip from No. 17 level to the surface being 2½ minutes.

Over No. 1 shaft there is a frame house covered with corrugated-iron sheeting. Adjoining the shaft house is the ore shed, hoisting-engine house, pumping-engine room, compressor room, boiler house, changing house, and blacksmith shop.

ORE-BREAKING SHED.

This building is 150 ft. long by 40 ft. wide. As the run of mine ore is dumped from the skip it passes over a grizzly. The fine ore falls through the grizzly into a bin sufficiently large to hold one shift's hoisting. The larger lumps of ore and rock pass over the grizzly into a car and are then trammed to the breaking floors in the ore shed. Usually each half shift's hoisting is dumped in one pile, as by this means the breakage in dumping the car is reduced to a minimum, and the breakers can work to better advantage. Lump ore coming from the mine varies from the size of the fist to lumps 1 ft. and more in diameter. These lumps are raked down from the conical piles in which they are left by the dumping of the lander's tram, and spread out upon the breaking floor. A space about 12 to 14



10-FT. PICKING TABLE

ft. square is covered with these lumps, and the ore breakers, generally two or three to each "floor," as the squared space covered with ore is called, go over it with hammers weighing from 8 to 10 lb., breaking the lumps in a preliminary way. After this has been done the breakers go over the floor with cobbing hammers, having handles 3 ft. long and weighing 2½ lb. each, and break the ore to such size that it will pass through a 3-in. ring. Each man can break from 4 to 5 tons per 10 hours, when the ore is moderately clean.

After the entire floor is broken to the required size, the "broken," as it is now called, is loaded into barrows by steel hand forks, and then dumped into chutes which empty directly into the wagons used in hauling the ore to Charlemont. The fine ore made in breaking the ore is shoveled into barrows, and stored in bins ready for loading into the ore wagons. While the ore is being broken, all rock runs over a sprocket wheel keyed on the main shaft of the Cornish pumping engine. As this engine is run nearly continuously and has generally surplus power, this is a convenient arrangement. The material passing through the trommel is "fines" and nut ore. This undersize is trammed directly to the trestle dump, the fines ready for shipment, the nut ore to be crushed and jigged in the concentrating mill which is 100 yd. distant from No. 1 shaft.

The oversize falls upon a McLanahan-Stone picking table of 10 ft. diameter. This table is revolved by a McIntosh vertical engine of about 6 h.p. Wheelbarrows are run under the picking table and the pickers standing about the circumference of the table, as it slowly revolves, pull the pieces of rock to the outside edge where they are caught by a bar and dropped to a tram below, while the ore is left on the inner portion of the table and falls into the barrows below.

timbered with square-sets from the surface to the bottom.

The method of working is the so called "old-fashioned Cornish underhand method." This plan of working has been followed almost continuously since the mine was opened out, though it was departed from in several levels, notably No. 12, No. 13 and No. 14 north, where the overhand or "back stoping" system was followed. In proceeding to open out a level, a small drift about 8 ft. high and 6 ft. wide is driven out from the shaft at a depth of 60 ft. below the preceding level. This drift is generally advanced for a distance of 30 ft. from the shaft ends, when a winze is sunk to open up the stope. As a rule the winze is sunk by hand work, though sometimes machine drills are used. It has not been found advisable to sink the winze deeper than 20 or 30 ft., as all material must be hoisted by windlass and it is easier to drive the remaining distance from the level below. The rise is driven

ORE SHED AT SHAFT NO. 1

COARSE AND FINE ORE DUMPS

and waste as well as every piece of copper ore is carefully cobbed out and set aside. Rock is trammed to the rock dump and the copper ore to a storage bin.

Eight cubic feet of solid ore in the vein is reckoned as one long ton of pyrites. Fine ore weighs 170 lb. per cu.ft.; broken ore 171 lb. per cubic foot.

This method of producing broken ore may be thought expensive, and some may inquire why mechanical crushers are not used, but the Davis company has perfected the system of hand breaking after some years of experience with power crushers, and has found that hand breaking yields a much less proportion of fines than does machine crushing. Usually 10 per cent. of fines is made in breaking by hand.

The portion of the skip's load which is small enough to pass through the bars of the grizzly is retained in the bin until the latter is full; then it passes through a trommel having an inside perforated plate with holes ¾ in. in diameter, and an outside plate of ⅜-in. perforations. This trommel is operated by a chain which The latter are dumped in the wagon chutes in turn. When hoisting muck and ore from the shaft it is necessary to screen wet, but at all other times the ore is screened dry.

With an average daily output of 100 tons it is usually necessary to run the table from three to four hours. This table furnishes a convenient and satisfactory means for cleaning the "broken" ore, as it comes from the trommel. As it must run in the comparatively open air during severe New England winters, the entire table is heated by exhaust steam, in order to protect the pickers' hands.

METHOD OF MINING.

Shaft No. 1 when first opened out was only timbered by stulls, as the walls in the upper levels were strong. However, as depth increased, it became necessary to timber the shaft with square-sets. The pump-way is timbered with square-sets from No. 5 level to the bottom, and the skipway from No. 13 to the bottom, yellow pine timber, with maple backing, being used. Ultimately No. 1 shaft will be

much faster than the winze, but as all holes (except when the water-Leyner drill is used) are dry ones the work is done under considerable diffculty, on account of the fine dust filling the lungs of the drillers. The Cover respirator was used with good results while putting up a raise last summer. Such respirators are cheap and rather effective.

After the winze and rise are connected the stope is opened up by taking a "bench" down. Usually a "12-hole" bench is started by drilling 12 holes on foot and hanging walls, about 2 ft. apart. The six holes nearest the winze are first fired and the bench split in that way; then this first bench is carried down one step in advance of the second bench. Usually when the ore is of average thickness it requires one month to take down a 12-ft. bench from top to bottom of the stope. Horizontal floors or jointing planes are found cutting the orebody at distances varying from 2 to 9 ft. apart measured vertically. Holes are always drilled nearly to these floors and the usual depth of hole is from 7 to 11 ft. Long holes give best

results. The distance from collar of hole to edge of bench varies from 18 in. to 2 ft.; never more than 2 ft. A hole on each wall is always necessary.

National dynamite of 40 to 50 per cent. strength is employed on the stopes and as the ore to be merchantable must not be over powdered, great care is used in charging the holes.

As a rule the ore is completely stoped out between hanging and foot, beginning at the shaft pillar. Formerly a pillar 12 ft. thick was in some cases left over the stope.

SURFACE PLANT, DAVIS MINE

This plan was abandoned because it necessitated driving an extra drift and the pillar thus left, in addition to being so much lost ore, usually caused trouble by falling and carrying all stulls with it and never stopping until it reached solid ground below.

One advantage in leaving this pillar was that when working the two levels together, it was not necessary to tear up the track in the upper level when starting a bench down the lower stope. When no such pillar is left the bench is usually taken down Saturday and Sunday, and the track made ready for tramming in the upper level by Monday. Long lagging timbers are used as stringers for bridging over the top of the stope, usually three 10-in. poles being employed. The 12-ft. pillar requires backing, and this is extra work; but the men working under it are safer than under the track.

In some stopes three benches are carried down simultaneously, though this plan usually results in considerable mucking down of the ore left on the lower benches by shots from the upper ones. When this plan is followed, the benches are found to be from 4 to 6 ft. wide. Rand "Little Giant" No. 2 drills are used in stoping, one runner and one helper being employed on each drill. The helper carries his own steel to and from the shaft. The third man on the drill is not necessary in the Davis mine. A peculiar local custom is the presence of the runner at the chuck, while the helper usually cranks the machine—the reverse of ordinary practice.

TIMBERING

Rock maple is used for stull timbering in the mine workings. The walls, more especially the hanging wall, are brittle, and break easily, so that timbering is absolutely necessary. Stull pieces vary in diameter from 1½ to 3 ft., and in length from 16 to 20 ft. They are footed down on the surface, and then swung into the shaft by the main hoisting rope. To accomplish this the skip is left at the lowest working level, and the rope uncoupled by means of a clevis and bolt, which fit on to the skip bail. The empty rope is then hoisted up the skipway to the surface, drawn out to the timber yard, and attached to the stull piece by a heavy chain. The stull piece is then pulled into the shaft mouth by the main hoisting engine, and lowered carefully down the skipway (which is lined with heavy planks). On reaching the desired level, the whistle signal is blown to notify the engineer to stop lowering, and the stull piece is pulled into the level by means of block and falls, and on to the timber truck, by means of which it is transported to the point where it is to be used.

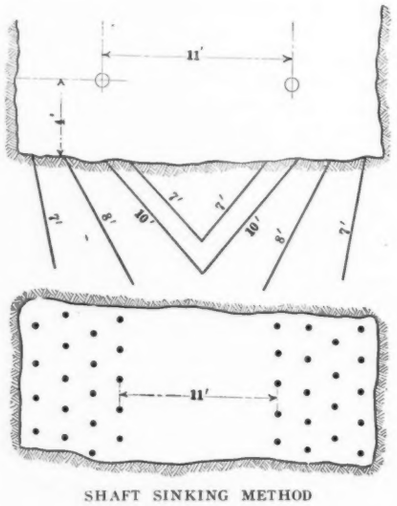
Stulls are placed 4½ to 5 ft. apart horizontally, and are given a pitch which is about at right angles to the dip of the vein. The top and bottom stulls are generally much heavier than the intervening ones. Four rows are placed in each stope, making the vertical distance between each row about 12 feet.

Hitches are cut by hand hammers and "points," which latter are of ¾-in. steel, sharpened at one end, somewhat in the manner in which a lead pencil is sharpened. Usually two good men, one holding and the other striking the point, can cut an ordinary hitch in a shift, or at most a shift and a half. Some progress has been made in cutting hitches by means of the Little Wonder hand drill and special hitch-cutting tool in places where the foot wall is not too hard. Where the wall is hard, nothing but the points will do the work. A hitch-cutting tool which will cut hard foot wall is greatly desired.

Headings for the stull pieces are rarely made, except for bearing timbers or in places where the stull piece is apt to receive heavy sidewise blows. The top and bottom stull pieces in each stope are lagged over with spruce poles, 8 to 12 in. in diameter. These poles are spiked on to the stull pieces with 10x⅜-in. boat spikes, a notch several inches deep being cut in the lagging to receive the spike. Each succeeding row of lagging is laid upon and breaks joints with the ends of the preceding row.

On all top stulls a piece called a "leveler" is placed after the lagging has been spiked on. No hitch is cut in the footwall for the leveler, which is merely wedged up tightly with soft pine wedges. Three spruce stringers 20 ft. long and 10 to 12 in. in diameter are strung across the levelers, lengthwise of the level, and on these stringers are laid the 4x6-in. hemlock ties for the tracks. Hemlock planks, 2 in. in thickness, are strung along the ties between the rails and outside of the tracks.

Usually the lagging on the top stull pieces is not brought up to the hanging wall, but a space 2 or 3 ft. wide is left at this point to permit of the top stull-pieces being hoisted up to the top of the stope. All stulls are hoisted into place rather than lowered. In each working stope there is a Gardner cargo winch, worked by hand power. A ¾-in. wire rope is wound around the barrel of the winch. At one end of the rope is fastened to the stull-piece to be lifted, and the rope is passed over the snatch blocks, which are hung from the top stulls over the track. These cargo winches are very convenient in timbering and are almost indispensable at the Davis mine.



SHAFT SINKING METHOD

No attempt is made to fill the stopes in this mine, but bottom stulls usually have from 10 to 15 ft. of rock on them which acts as deadening. Waste rock is thrown on stulls in levels below, when practicable.

(To Be Continued.)

COMPOSITE METALLURGICAL VESSELS*

A New System of Making Zinc Retorts and Refractory Crucibles

BY A. L. QUENEAU†

The conditions obtaining in zinc-distillation furnaces call for retorts or muffles able to meet many trying requirements. These may be stated as follows: (1) High refractoriness to withstand temperatures that often reach 1600 deg. C. (2) Chemical composition adapted to resist the corrosive action of bases, such as FeO, MnO, CaO, MgO, etc., and of fusible sulphides and compounds, such as ferrous sulphide, fluorspar, garnet, etc. (3) Good heat conductivity, since the charge is heated only by transmission through the vessels' walls. (4) High tensile and compressive strength, together with the ability to resist the abrasive and impact blows of the charging and cleaning tools. (5) Dense walls, to be little penetrated by the metallic vapors. (6) High elasticity in order to endure the repeated contractions and expansions due to the varying temperatures. (7) Low cost.

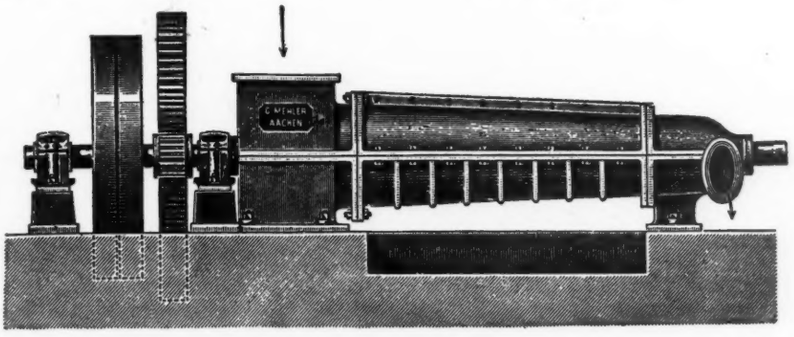


FIG. 1. MEHLER PUG MILL

The cubic contents of the vessels are made as large as practicable, without, however, increasing the length of the heat travel. It follows that the cross section selected is usually elliptical, the length of the vessel being about 5 ft. The charge submitted to distillation may reach 100 lb. The retort is supported freely at both ends and behaves as a uniformly loaded beam. The cross section varies between 7 in. in diameter for the circular section and 6 to 8 in. in width for the elliptical section inside dimensions; the thickness of the walls may be as low as 1 in. and as high as 2 inches.

The retorts may be manufactured in three ways, viz.: By hand, by the so-called tile machine, and by the Dor hydraulic press. The first process is obsolete outside of Silesia. The tile machne is in use in many parts of the United States, while the Dor press, or modifications of it, is operated in all modern plants.

Aside from the cost of manufacture, the three types of vessels are differentiated principally by the water content in their green state. The hand-made retort has the highest, and the press-made the lowest, the tile-machine made being intermediate. The water varies evidently with the requisite plasticity of the batch. Molding by hand can be done only on very plastic material, while a pressure of 1500 lb. per sq.in., the working pressure of the Dor press, can force through the press die a clay wad of low plasticity. In order to produce vessels able to withstand, while green, their own weight without collapsing, the thickness of the walls and butt is made to vary as the plasticity; the hand-made vessels even then have to be supported for several days in wooden forms.

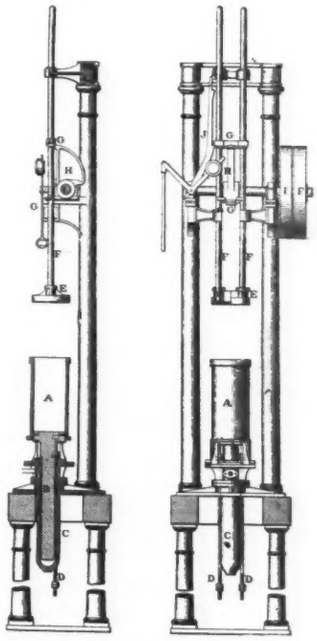


FIG. 2. HAMMERING MACHINE

The water held by the clay is later driven off, partly during the aging period of three or four months, finally during tempering. The vessel as placed in the reduction furnace is then porous, the more porous the greater the original water content. This porosity results in numerous disadvantages. It increases enormously the soakage of zinc, and the loss through filtration; the cutting action of the fusible slags and compounds is also rendered easier by the open texture of the walls, and the life of the vessel is thereby shortened. A further advantage of the press-made vessels lies in the fact that they are made in one piece, butt and all, while the tile-machine made retort is manufactured with a hole left in the butt; this is plugged by hand in a subsequent operation.

The thick-wall vessels being very heavy are liable to be injured during the numerous transfers between the pottery and the furnace; a shock not sufficient to break the vessel will often result in weakened spots which will crack under the least provocation either in the tempering kiln or the reduction furnace.

In actual operation in the same plant treating the same ore, in similar furnaces operated under exactly similar conditions, the use of press-made retorts results in an increase in the metal recovery of from 5 to 6 per cent. The cost of manufacture is slightly higher with the hydraulic press than with the tile machine, but this difference is many times offset by the increased efficiency of the furnaces. The same grade of unskilled labor can operate either machine, providing that an experienced foreman is in charge.

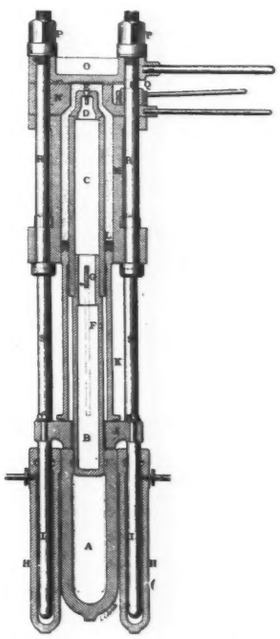


FIG. 3. HYDRAULIC RETORT PRESS

From the foregoing it will appear that the Dor press should always be installed

*U. S. patents Nos. 789,451, 789,452, 789,453 and 792,452; French patent No. 354,319; Belgian patent No. 184,572. Other patents pending.

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in new plants and in almost all cases it is a good investment to tear down the tile machines to give way for the presses.

In spite of the superior article obtained from the hydraulic press, the retorts are found deficient in many instances when the charge is high in manganese, iron, lead, etc. These impurities will result in an increase in the number of vessels consumed per ton of spelter produced. With a fusible charge the resulting slag bores through the walls and dripping down to

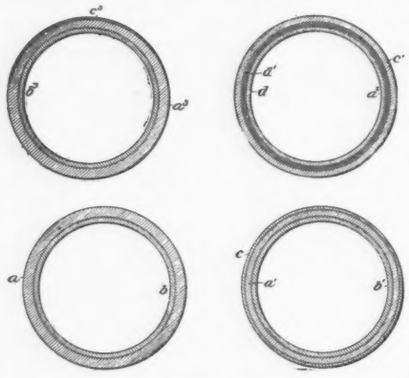


FIG. 4. CROSS SECTIONS OF COMPOSITE METALLURGICAL VESSELS

the next retort corrodes that one as well; often the loss of a whole tier will follow the boring of a top vessel. With a fusible charge the condensers are often filled with the so called "beef tongues," formed of chilled slag that found its way into them.

The monetary loss caused by the removal of a bored vessel and its replacement by a new one, is not covered by the mere first cost of the retort. The loss comes from several cumulative causes that may be enumerated as follows: (1) Cost of the new vessel. (2) Increased time of the maneuver due to the handling of the old and new vessels. (3) Loss of zinc absorbed in the walls of the vessels; this absorption is very rapid for the first few days and decreases rapidly until saturation has been reached; with large 8x10-in. muffles, with walls 2 in. in thickness, the soakage period is of about seven days' duration, while it is of two days in the case of hydraulic-press vessels. (4) During the absorption period the condensation of the zinc vapors to spelter is very poor, owing doubtless to the dilution of the vapors; the flame burning at the tip of the condenser has during this time a characteristic "wild" appearance.

The last three headings, the subsidiary causes, may be considered to be even more important than the first and more apparent one, viz., the cost of the vessel. It is difficult to place an exact figure on the aggregate. The loss by absorption can be calculated if the average zinc content of the discarded retort is known, together with its weight. The tile-machine retort may contain as much as 16 per cent. of its weight of zinc, while the hydraulic-press retorts carry seldom as high as one-half of the above figure, usually about 7 per cent.

In order to be able to treat without any special care and undue loss of retorts the comparatively cheap mixed sulphide ores, high in iron and lead, or other ores of easily fusible character, a vessel more refractory than even that produced by the hydraulic press has to be provided. Such a vessel can evidently be made by substituting a suitable refractory material, such as chromite, graphite, bauxite, carborundum, etc., for the chamotte or sand of the fire-clay mixture. The vessel so made is very costly and to pay for the increased cost it should have a life several times that of the ordinary press-made vessels. However, for practical reasons it is not good policy to keep retorts in the furnaces after certain conditions have obtained. Thus with fluid slags, even with careful cleaning, the thickness of the retort walls becomes greater and greater by the accretion of slag, and soon a condition is reached, because of decrease in the thermal conductivity through the walls, when it becomes economical to remove the vessel, though it may often be perfectly whole. With direct-fired furnaces, especially if operated under forced draft, an additional trouble is encountered, viz., that of the formation on the outer walls of the so-called moss, caused by the ash particles carried away by the rising gases. There is therefore a series of conditions that militates against the use of a very long-lived vessel.

A vessel made of an expensive refractory mixture when removed from the

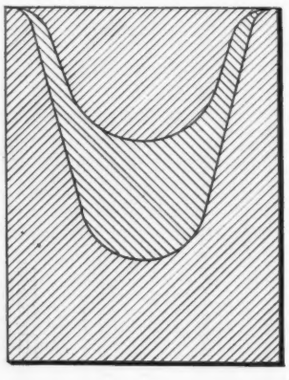


FIG. 5. CROSS SECTION OF COMPOSITE CLAY WAD

furnace would still retain in its walls a large amount of the costly refractory mixture, which would of necessity be wasted. Rationally the refractory mixture should be applied in the portion of the vessel where its special properties can do good and there only. Composite metallurgical vessels fulfil this economical condition.

Between the low-price vessel, often bored prematurely and the expensive very long-lived retorts there is room for an article of higher refractoriness than that of the ordinary retort and of a cost that will not prove prohibitory. To attain this end it has been proposed to coat the surface of the retort with a basic material, such as dolomite, magnesite, etc., and to unite the coating with the surface of the retort by means of a sintering agent, water glass, interposed between the walls of the retort and the otherwise non-adherent basic material. This involves, first, the preliminary manufacture of the retort proper; second, the coating of the retort with the silicate of soda; third, the coating of the retort with the basic material; and fourth, the subsequent sintering operation.

In order to avoid the expensive rehandling of the vessel as well as the addition of the injurious fusible silicate,[1] I have evolved a process for the manufacture of composite retorts or muffles by means of the Dor hydraulic press; the press is not modified in any way, the change is made simply in the *modus operandi*.

The composite retort is obtained in one operation, the completed article having a main body portion of the usual fire-clay and sand mixture, and having an outer surface of predetermined and suitable thickness made of a mixture of fire clay and of a basic or neutral material, this material taking the place of the customary sand or chamotte, either wholly or partly, as required by the particular exigencies of use. The outer surface may be the interior of the retort or both, though for zinc metallurgy it is sufficient to protect efficiently the inner surface.

The two batches of fire clay are pugged separately in a Mehler pug mill, Fig. 1., in the usual manner, care being taken to produce batches of substantially the same plasticity. The *modus operandi* of the Dor hydraulic press operated for the manufacture of ordinary vessels is as follows: The pugged fire-clay ballots are fed one at a time in the cylinder *A* of the hammering machine, Fig. 2, where they become consolidated into a wad by the stamping of the shoe *E*. The wad having grown to the requisite length, it is removed from the hammering machine and transferred to the press, Fig. 3. The punch *D* and its plunger *C* have previously been allowed to recede to their lowest position, and the top piece *O*, as well as the die *N*, have been swung around the column *R* so as to uncover the receiver *M*, in which the wad is placed. The die *N* and the top piece *O* are then swung back and locked in the position shown in the illustration. The hydraulic pumps are started. The punch *D* is thereby made to rise. It stops at a fixed elevation to form the butt *E* of the retort. The automatic stopping of the plunger *C* is obtained by the large key *G* coming in contact with a steel plate. The

[1]The remark in regard to the water glass applies equally well to the common method of glazing the outside of retorts by the preliminary application of a fusible and sintering compound. Under natural conditions, with direct or producer-gas fired furnaces, a glaze is soon formed, owing partly to the vitrification of the skin of the retort and partly to the fine ashes sticking to the vessels.

plunger *C* having stopped, the water forced from the pumps finds its way through a 4-way valve, not shown, in the twin cylinders *H H*, causing the yoke *J* and thereby the annular plunger *L* to move upward, forcing the clay wad between the receiver walls, the center plunger *C* and the top piece *O*. When the pressure to which the clay is subjected has reached the proper intensity, the pumps are stopped, the pressure temporarily relieved and the top piece unlocked and swung aside. The pumps are started anew, and since *C* is now in a fixed position, *L* rises, forcing out the clay between the punch *D* and the die *N*, thus forming the retort outside of the press. The equilibrium of pressure is established between the interior of the vessel in process of formation and the atmosphere by means of the air vent *F* and the poppet valve at *E*, The retort having reached its proper length, the pumps are stopped, and it is cut off above the press by means of a wire and removed to the dry room.

The punch *D* and the plunger *C* are lowered, as well as the annular plunger *L*, and the die *N* is swung open around *R;* the clay remaining in the receiver is removed, and the press swabbed with oil; it is then ready for the next wad.

It is seen that on account of the automatic action of the press that particles of clay placed in like position in the various wads cover always the same path while the retort is being made, and always go to form the very same portion of the finished articles.

Thus if experimentally the relative positions of the particles in the wad and in the resulting retort are discovered, it will be some possible to substitute, in the proper zone of the wad, the clay and sand mixture by a suitable refractory mixture to form the desired protective coating and this, it wish, in any portion of the vessels. When the press is operated for composite vessels, a wad, Fig. 4, is made by feeding the proper pugged-clay mixture, in the requisite relative amounts, into the receiver *A* of the hammering machine. The position of the supporting piston is shown to the operator by means of a U-shaped iron rod connected to the under side of the piston. The top of this index travels in front of a board on which is marked the thickness to be given to the different layers or zones of the composite wad; it is an easy matter to produce constantly wads of exactly similar formation. The composite wad is introduced in an inverted position in the receiver of the press.

In starting the manufacture of composite retorts, an initial batch of fire clay, sand, and the selected refractory is prepared. This batch is made sufficiently large for the first day's run. The refractory mixture for the following days is obtained by using the press wastage as well as that from the hammering machine; to each barrow load of this material an appropriate weight of fresh refractory is added; the whole is then thoroughly mixed and pugged. The composite wads being of uniform length as well as the vessels, it follows that the amount of wastage is also a constant, and that the process once started, it is a simple matter to secure a uniform composition in the refractory mixture.

In Fig. 4 is illustrated the wad for a retort of the cross section of Fig. 5. It is quite evident that, in the metallurgy of zinc, any refractory material placed in the butt would be wasted. The placing of the top clay layer in the wad serves a double purpose; it removes the refractory mixture from the butt, as well as reducing the amount of refractory mixture in the press waste. By the use of the top layer a vessel is made with a very thin inner layer of fire clay and sand mixture of about 1/16 in. thickness; in case of carbonaceous refractories this layer gives an important protection against the oxidizing action of the hot gases in the tempering kiln.

The same number of composite vessels is made as when the press is used for the manufacture of ordinary retorts. The extra cost over the ordinary retorts is solely due to the difference of price between the fire clay and the selected refractory. This extra cost will vary between 30c. for a Ceylon graphite mixture, and 15c. for carborundum sand mixture. The thickness of the protective layer is usually made 3/8 in. The different portions of the composite retorts (having the same proportion of the same plastic material, i.e., fire clay) are knitted together under the great hydraulic pressure, so as to form a homogeneous body.

In a test lasting several months made at the Palmerton plant of the New Jersey Zinc Company, it was found that with a protective layer formed of a mixture of Ceylon graphite with fire clay, an increase of life of 33 per cent. was secured. These results were obtained in treating willemite ore of the following composition: 46 per cent. zinc, 3 per cent. FeO, 8 per cent. MnO, 1.8 per cent. MgO, 3.50 per cent. CaO, 24 per cent. SiO_2. A large-scale test on some 10,000 retorts is being carried on, in the Kansas plants of the Prime Western Spelter Company, in smelting Colorado ores which have been treated by the Wetherill magnetic separator plant at Cañon City, Colo. The roasted zinc concentrates have the following average composition: Zn, 54.8 per cent.; Pb, 6.4 per cent.; Fe, 14.3 per cent.; SiO_2, 3.1 per cent.

The method herein described for the manufacture of composite retorts for the metallurgy of zinc applies, with the necessary modifications, to the manufacture of composite cruicibles made in a suitable press[1]. The composite crucibles made under this process are specially well suited to the manufacture of crucible steel, brass, for the thermit process, the smelting of the gold precipitates of the cyanide process, and for other purposes.

[1]U. S. patent No. 792,452.

Qualifications of an Engineer

In an address delivered before the engineering apprentices of the Allis-Chalmers Company, at its Cincinnati Works Aug. 30, 1906, Prof. V. Karapetoff, Cornell University, outlined the lines of study, thought and practice, which an engineering student should follow, in a very illuminating and instructive manner. In outline, he said: Three essential conditions for a successful engineer are: (a) Professional knowledge; (b) knowledge of business forms and of human relations; (c) strong character.

While in the works learn the construction of machinery, the manufacturing operations and testing. The question "why" is of decided importance; do not be satisfied with "how." Get into the habit of analyzing.

To get full benefit from the factory work: (a) Keep regular notes on your work; (b) make sketches; (c) keep on a separate sheet your doubts, to be straightened out at a future opportunity; (d) make rough check calculations on the machine you are working with.

Devote part of your evenings to systematic study. Read at least one engineering magazine regularly, and keep some kind of an index of information on at least one subject in which you are particularly interested. Go over your college books and notes and see that you are sure in fundamentals. Gradually get familiar with the standard engineering books. Select some one branch of engineering, and devote all your extra time to it. Do not miss a chance to make an original investigation whenever you have an opportunity.

Observe the characters of men you are working with; in particular, the influence of age; education, nationality, etc.; things that make them successful; things that are an impediment in their work; things that they would like to have; things that make them happy and unhappy; betterment work that they would appreciate. Observe the foremen, and their ways of conducting their departments; make clear to yourself what you would consider an ideal foreman. Do not judge the foremen by the way they treat you. Observe the general factory system. Get a thorough understanding of the significance of cooperation in modern industry. Do not get rusty in regard to general life questions; continue reading books on philosophy, economics, history, etc. This will make human relations clearer to you. Besides, a man in a responsible position must be a well educated man; he should be posted on many general things, and ought to be able to speak about them.

All schemes of ore-deposit classification rest upon these principles: Form, origin, state of aggregation, and mineral contents. The form classification is often erroneously thought to be the best, as it involves the least amount of speculation.

CAPE NOME PLACERS

Estimate of $4,000,000 Production in 1906—Peculiar Occurrence of the Gold—Mining Conditions

BY E. B. WILSON*

That part of the Seward peninsula adjacent to Cape Nome is attracting attention owing to the richness of its placers. Gold was discovered near the beach at Cape Nome in 1899, but it is only within the last four years that the district has been prospected and worked to any extent. The output for the Nome district in 1903 was $2,200,000; in 1904, $2,185,000; in 1905, $2,850,000; in 1906, $4,000,000. The figure for 1906 is estimated, the increase being attributable to new mines being discovered on the tundra.

The tundra mines are the most interesting at the present time on account of their richness and possibilities. Pay streaks in the tundra are found at from 60 to 130 ft. below the surface, and are composed of ruby and black sands, above which rounded beach gravel and gray sand alternate. The bed rock in the tundra is of sedimentary origin, but has been metamorphosed by solutions that in some way penetrated them subsequent to the deposition of the gravel. This is a peculiar statement and might be questioned were it not that I have before me specimens of bed rock from the Solo and Portland benches of Little creek. The former looks like graphitic schist with quartz and other pebbles stuck to it. On the quartz and where it joins the schist flake gold is in evidence. The rock is so hard it could be mined by drilling and blasting, and then would need crushing to free the gold.

The bed rock from the Portland bench is entirely different in structure and color, being light brown, evidently consolidated mud, through which flake gold, grains of magnetite in grains and some garnet are incorporated. The magnetite crystals must have sunk into the mud, for some of them are not abraded or pulverized, thus furnishing another peculiar condition to mystify one in regard to the origin of the placers.

The most prominent rocks of this vicinity are schists and limestones that have been disturbed by intrusions of granitic and greenstone rocks. Both the intrusive and schistose rocks have been shattered, and contain small quartz veins that carry gold. Usually placers have been formed by the disintegration of gold-bearing rocks in place or by water carrying gold-containing rocks some distance, until they are ground so fine that the gold is loosened. If one undertakes to explain the origin of the Cape Nome deposits on either of the above assumptions, the conditions that confront him are so peculiar that about all that can be said with safety is that the placers are there.

There are three ancient beaches known to exist, and their extent furnishes three theories for the purpose of formulating some definite rule whereby the expense connected with prospecting can be minimized. One theory is that glaciers formed the placers by pushing ahead of them the gold and mud that they ground from the rocks in place. Another theory is that the waves of the Arctic ocean pounded the rocks to pieces, and concentrated the gold. Still another theory is that receding waters and subsequent upheavals produced the placers and the beaches. It is possible that the gold on bed rock comes from the disintegration of rocks where it is now found, and that melting glaciers furnished the gravel above the pay streaks; otherwise

MINING ON LITTLE CREEK

The coast between Point Rodney and Cape Nome, a distance of 25 miles, is being worked on what is termed the old beach line. This ancient beach extends back from the surf a distance of about 2500 ft., and has a pay streak 20 ft. above sea level and from 12 to 32 ft. below the surface. From the westerly base of Cape Nome, gravel terraces rise gently to the north and west, forming ridges that extend four or five miles inland until their highest elevation, 250 ft., is reached. Between these ridges at intervals are broad circular valleys that form the tundra. The only rocky peak to break the monotony of this dreary section is Mount Osborn, whose formation suggests an island rising from the sea.

Within the last two years the tundra has been prospected by sinking shafts and by Keystone drilling machines, showing that the placer is of greater extent than was anticipated, besides furnishing data which indicate that further extensions can be depended upon. Considerable dissatisfaction exists at Nome owing to land grabbing and the conditions of the mining laws that permit it; further, the land grabbers neither work, nor lease their holdings, so that what might be productive ground is idle.

* Mining engineer, Scranton, Penn.

the magnetite and garnet crystals would have been smashed, and the gold would not be incorporated in the mud.

A mine recently developed is the Bessie, which has a bench that is thick, wide and long, besides being fabulously rich. The lowest value per pan was 23c.; the highest value, $300; while the average pan contains $3.50. The smallest clean-up for any day's work amounted to $12,000, and $35,000 has been taken out in one shift.

The large illustration shows the mining operations on Little creek. The small-sized mountains are ore piles that have been mined during the winter. Mining is carried on by steam thawing, loading into buckets or cars, hoisting the dirt to the surface and dumping it in piles. The second stage of the operation takes place in summer or as soon as the ground thaws and water runs. The piles are worn away, this portion of Alaska will have more economical methods to save the gold. In 1903, the Seward peninsula produced $4,160,000; in 1905 $4,860,000; and according to late reports the production should approximate $9,000,000 in the present year.

The Application of Foundry Blowers

The general application of a pressure blower of the fan type to a cupola is too well known to require description; but certain features which relate to its efficiency often escape attention. The proportions of a pressure blower wheel should theoretically be such that its capacity area or square inches of blast shall be practically equal to the free area through the fuel and iron in the cupola, less the influence of the resistances of piping, tuyere boxes, fuel and iron. These resistances are evidently the equivalent of just so much reduction in area, and must therefore enter into any consideration. But it is manifestly true that differences in the length and arrangement of piping in different plants, and of size, quantity and character of the charges in the same plant, introduce such variable conditions that it is impossible to design a blower of any type that shall at all times be just exactly proportioned to the work to be done. For this reason the exact power required to operate any given blower cannot be given as an absolute quantity, but can only be determined when all of the conditions are known.

It is, or at least it should be, customary, in specifying the pressure required to operate a cupola, to refer to that in the wind box. On the other hand, the table of blower speeds presented in the catalogs published by the B. F. Sturtevant Company gives the number of revolutions necessary to produce the given pressure at the fan outlet when its area is within the capacity of the blower. Owing to losses due to transmission, this pressure cannot be maintained at any more or less distant point, such as the wind-box of the cupola, unless the speed of the fan is increased sufficiently to produce an excess of pressure equal to the transmission loss.

It is the failure on the part of the purchaser to comprehend this fact, and to make due allowance for transmission losses, that sometimes results in too low a pressure at the cupola, and an unjust charge against the blower. Large, straight and short connections from blower to cupola are always imperative if waste of power is to be avoided. If changes in the direction of the piping are necessary, they should be made with as large a radius of curvature as possible. It should be distinctly understood that the power required to operate a fan blower is proportional to the area of discharge. If this area be reduced to zero, by the closing of the blast gate, the power will be reduced to merely that due to friction of the machine and the air confined within the case. Too often it is claimed, by those who ought to know better, that closing the pipe increases the power; but, as power is expended only when air is moved, the fallacy of this statement is evident.

MINING ON LITTLE CREEK

then attacked by teams and scrapers that carry the dirt to the head of the sluice box. In the box are riffles for holding the gold washed from the dirt, the latter being carried along and dropped out of the lower end of the sluice box. As there is little fall to the ground, the tailings are carried away by scrapers and spread out.

Water is scarce in some localities, but ditches are being increased in number and length, which will greatly relieve the situation. Hydraulicking cannot be carried on except in gulches where there is a good fall to remove the tailings. Thawing by steam is expensive at present, with coal at $30 per ton; hence only the richest of the pay streak is mined. No mercury is used in the riffles to catch the fine gold and that is lost, although it has been demonstrated in one case at least, that mercury would save $10 in fine gold daily. After the first flush of success has

In spite of the supposed superiority of an ore-deposit classification based on form of orebody, the best opinion is that the genetic classification, that is, based on origin of the ore, although largely hypothetical, offers the most serviceable system.

DETONATING CAPS FOR BLASTING*

A Practical Discussion of the Principles of the Detonation of Powder—How Blasting Caps Should Be Used to Secure the Most Economical Results—Importance of Their Function

BY ROLAND L. OLIVER

The general principles of the detonation of powder and the important function that blasting caps play in the successful breaking of ground are much overlooked in practical blasting and in mining literature; and miners, in spite of their experience in placing and drilling of holes, and in the handling of powder, are troubled with premature blasts, smoky shots, unbottomed holes and misfires, and are perplexed as to the cause.

This paper will undertake to present some notes upon the values of different caps or detonators in developing the energy of explosives, so that a better knowledge of their relation will aid in a judicious selection of caps, which, together with a proper regard for apparently insignificant details, will materially assist in removing or at least lessening the recurrence of those undesirable conditions above mentioned.

MAXIMUM STRENGTH OF POWDER—HOW PRODUCED.

Detonators or blasting caps are made in several different grades of strength, because some powders require not only a greater but a different initial detonation than others to convey their maximum energy through a whole charge, and the detonating qualities of each powder vary by changes in its physical condition—whether it be warm or cold, rigid, plastic, homogeneous or otherwise.

The full significance of "detonation," as applied to high explosives, will become apparent in the course of this paper, but briefly it may be stated that detonation is a very much higher degree of explosion than that produced by fire alone or by a blow. While either of these will explode powder under certain conditions, neither of them will cause it to produce its greatest effect. An explosion is merely the rapid transformation of powder from its solid or liquid state into gases which struggle to occupy a space hundreds of times greater than that occupied by the original substance; but in order that these gases may produce their greatest rupturing force on the surrounding material, they, too, must be expanded suddenly to their greatest possible volume. This requires a practically instantaneous decomposition and oxidation at maximum temperature into their simplest elements, the result being the highest degree of explosion, which is called "detonation," and which can only be produced by a peculiar combination of intense heat and concussion, such as is supplied through the agency of detonators, or blasting caps, as they are commonly called. Hence, a thorough detonation of powder is controlled by the cap, the nature and strength of which is as essential to successful results as is the powder itself.

The susceptibility of powder to detonation depends more upon the nature of its ingredients and on the physical conditions previously mentioned than on the amount of nitroglycerin or high explosive which it may contain. For instance, ordinary dynamite, with 40 per cent. nitroglycerin,

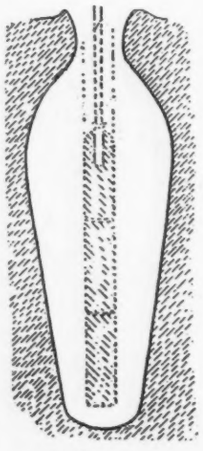


FIG. 1

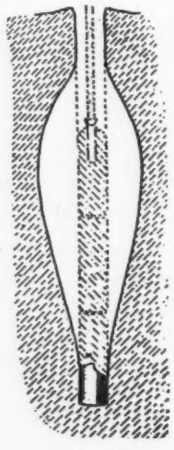


FIG. 2

is easier to detonate thoroughly than a gelatin dynamite containing even as much as 80 per cent. nitroglycerin, because in the first the liquid nitroglycerin is merely absorbed mechanically in a dope, whereas in the latter it is chemically transformed with guncotton into a gelatinized mass, which is harder to detonate and harder to make transmit its detonation through a whole charge of it than ordinary dynamite; that is, a comparatively weak cap will detonate a longer charge of straight dynamite than of gelatin dynamite, yet gelatin dynamite, when detonated with a suitable cap, is somewhat stronger than ordinary dynamite containing the same amount of nitroglycerin and possesses greater shattering effect.

A spark will detonate fulminate of mercury; 2 grains of fulminate will detonate nitroglycerin; but it requires at least 10 grains of fulminate to detonate guncotton. That there is something more, however, than the actual force and quickness of these 10 grains of fulminate is shown by the fact that, although the mechanical force of nitroglycerin is more than that of fulminate of mercury, ten times more nitroglycerin or 100 grains, will not detonate guncotton; it will only scatter it, yet a small quantity of dry guncotton, which is slower than nitroglycerin, will easily detonate nitroglycerin and even wet guncotton, which are the two extremes, nitroglycerin being one of the most sensitive and wet guncotton one of the most inert forms of high explosives. Therefore the equilibrium of the different chemical molecules of these powders is susceptible to explosion not merely by the force of the shock, but by different kinds of impulses or vibrations. Another example of the disruptive effect of a particular wave motion without especial mechanical force are the glass globes frequently exhibited in physical laboratories, which withstand a strong blow, but are shattered by the mere vibration of a particular musical note, whereas a note of different tone will not affect them.

The different degrees of facility with which some explosives will detonate others, and their susceptibility to one kind of detonation more than to another, must now be apparent. Let us next consider the action of the same explosive under different influences. It appears to many that when a charge of powder explodes at all it explodes with maximum force throughout, but such is not the case. For instance, a large number of sticks suspended in the air close enough to explode one another (12 to 36 in. apart, according to the kind of powder and size of cartridges used) will explode down the line for a certain distance if a detonator be used to start the first stick, but a point will eventually be reached where one will not set off the stick next to it, showing conclusively that each successive stick of powder has lost some of its detonating force.

That its explosive force also becomes weakened as it proceeds down the line may be illustrated by placing under each stick a thin plate of soft steel over the end of a piece of 4- or 6-in. iron pipe. The force of each explosion striking these plates of steel will cup them into the hollow of the pipe and the size of the cups will diminish as the explosion gets farther away from the initial detonation. It has also been demonstrated that when the first stick is fired with a weak cap the sympathetic detonation will not extend far down the line; per contra a very strong cap, or one of some other composition to which the powder is more susceptible, will carry the detonation much farther.

DIFFERENCE BETWEEN COMBUSTION, EXPLOSION AND DETONATION.

The effect of merely lighting a piece of unconfined dynamite with a squib or

*A paper presented at the recent meeting of the California Miners' Association, at Nevada City, California. Reprinted by the California Cap Company, Oakland, California, the original proceedings having been on the press at the time of the San Francisco fire, and destroyed.

piece of fuse without any cap attached is that the dynamite will burn quickly without exploding, and make a dense smoke which has a disagreeable smell and produces violent headaches. This is simple combustion. Confine another piece of dynamite, and light it in the same way and it will explode, but it will belch forth similar fumes. A very weak cap, like the old single-force cap, fired in dynamite will explode it with considerable energy, but there will still be some of the objectionable smoke. Repeat the experiment with a triple-force cap and the dynamite will be detonated with great violence even when unconfined, developing great explosive force and very little smoke. This illustrates the difference between combustion, explosion and detonation, showing that the same powder may be made to transmit its energy by different means and with different degrees of intensity from a rapid burning to a violent detonation.

The relative strengths of three well known explosive compounds have been compared when exploded by fire simply and then by detonation. Considering the explosion from simple inflammation of gunpowder as unity, guncotton when exploded simply by fire is three times stronger than gunpowder and when detonated by a cap it is six and one-half times stronger. Nitroglycerin is five times stronger than gunpowder when exploded by fire and ten times stronger when detonated. Hence these figures explain the enormous force which is given by detonation as compared with that by simple explosion.

FIG. 3

FIG. 4

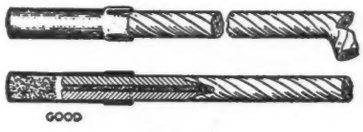


FIG. 5

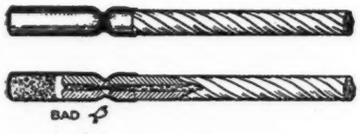


FIG. 6

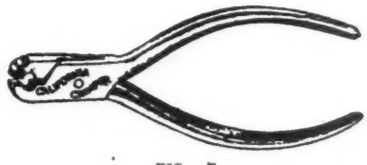


FIG. 7

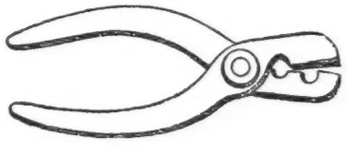


FIG. 8

CONDITIONS INFLUENCING DIFFERENT POWDERS.

Gelatin powders do not transmit their explosive energy through themselves as readily or as far as regular dynamites, hence they require a stronger detonator, larger cartridges and more confinement completely to detonate a whole charge. A 3X cap gets nearly all the energy out of No. 1 and No. 2 dynamite, but gelatin dynamites, nitrogelatin and other inert powders require at least a 5X cap to develop their energy, and a 6X or stronger cap will do it still better, especially if the charge be a long one. This relation between the length of charge, the diameter of the stick and the strength of caps is another noteworthy fact, more marked with the inert powders than with ordinary dynamite. Thin sticks require a stronger cap than sticks of larger diameter and a long charge, especially of slender sticks, requires a stronger cap to convey sufficient impulse through the whole charge; otherwise all the powder in the hole will not be detonated.

The so-called "fumeless powders," meaning that their gases are not visible or noxious, are only fumeless in that sense of the word when well detonated. If the fuse burns them, or the cap is too weak, they, too, make "stinkers" and produce headaches. A poor detonation of gelatine and other inert powders, which does not go all through the charge, will disintegrate some of the other sticks without exploding them, leaving the hole unbottomed and scattering the unexploded powder about the mine, which is dangerous. This sometimes happens when the cap has been buried under several sticks of powder and there is no tamping on top of the charge.

The matter of tamping high explosives is much debated amongst miners, many asserting that it is unnecessary. As a matter of fact, tamping is not so essential with high explosives as with black blasting powder, because in the one case the expansion of gases is so sudden that just a small proportion get a chance to escape, while in the case of slower powders the expansion is gradual; but in any explosive the better the confinement of the gases the greater will the effect be. The fact is, however, that most blasters use an excess of powder so as to make doubly sure of breaking the ground, and this excess also makes up for the loss of power by the escape of untamped gases.

Close confinement, by ramming the powder well into a hole so as to fill up any spaces around the charge, is also important, as much of its effectiveness may otherwise be lost. For example, a quarter of an ounce of No. 2 dynamite will throw a ball of certain weight from a mortar 300 ft. Leave ½-in. air space between the ball and the powder and the same quantity of dynamite will throw the same ball only 210 ft., lessening the distance 90 ft. in 300, which is a loss of 30 per cent. of its efficiency.

Several years ago a mining superintendent in Arizona noticed irregularities in the progress of different shifts. Some of the miners complained of unbottomed holes and bad air. He was supplying them with 40-per cent. gelatin dynamite, ⅞-in. sticks and 5X caps, shift and shift alike, but with no more powder than his foreman considered was sufficient to do the work. Upon investigation it was found that one shift always rammed the charges with a wooden bar and put tamping on top, but the other shift was not tamping. All hands have been using tamping ever since, and work has proceeded satisfactorily with the same powder and caps.

Another consideration in handling any powder is the diameter of the sticks used. Seven-eighths inch sticks require more confinement and greater initial impulse than 1¼-in. sticks to carry the detonation through the charge, because the more powder there is in the immediate vicinity of the cap, the greater will be the initial explosive energy established, and this is particularly essential with gelatin dynamites and other inert powders.

When powder becomes chilled, it is difficult to detonate it properly with the usual detonator, hence the advisability of using a very strong cap in cold weather. Many of the holes are frequently loaded for some time before firing, and even if the powder is soft and normal while charging, it afterward becomes somewhat chilled in the cold ground. As said before, a 3X cap, or even a double-force cap, will detonate ordinary dynamite if it be soft and plastic. But on the other hand, if it be hard, or if it should present a mottled appearance, even a 5X cap may fail to detonate it completely.

SELECTION OF DETONATORS.

It is the nature of the initial detonation to the powder around the cap which governs the greater or less effect of the explosion of the whole charge. The cap communicates to the first particles of powder a disruptive impulse, which according to the nature and strength of the cap more or less completely overthrows their equilibrum and decomposes the powder with great energy, setting up sympathetic vibrations which explode the next particles of powder and so on by the violent disturbances or friction between them in a regular succession of impulses and decompositions, which, if started with suf-

ficient energy, are of such intense heat and velocity that the rupturing force of the explosive is developed practically instantaneously. This detonation has already been shown to be not only the result of mechanical force, but a combination of extremely sudden chemical and dynamical or impulsive reactions which set up vibrations to which different powders are more or less susceptible, and these explosive reactions will be propagated through the mass of the powder according to the intensity of the vibrations and the resistance with which their motion is opposed by the nature and consistency of the powder, whether it be difficult or easy to oxidize, soft and plastic like dynamite, or hard. If the initial detonation of the powder surrounding the cap is of the highest degree, the vibrations will be most intense and will be propagated farther through the mass than by a poorer detonation. Hence the different degrees of detonation. Unless the first particles of powder are so thoroughly de-

FIG. 9

composed by a detonation of high order, or first degree, as to convey the necessary heat and energy to detonate the whole charge, the greatest force of the powder will not be developed. There will frequently be unbottomed holes or pieces of

FIG. 10

unexploded powder scattered about, or both, and the air in the mine will be contaminated with some obnoxious gases which have not been completely oxidized.

The accompanying illustrations are from cross-sections of explosions in solid lead cylinders, and represent graphically the difference in force developed. Fig. 1 is a good detonation from a strong cap. Fig. 2 is a poor detonation from a weak cap in the same quantity of powder. Some powders may lose as much as 20 per cent. of their effectiveness, unless fired with a suitable cap. No. 1 dynamite poorly detonated is less effective and more obnoxious than No. 2 dynamite thoroughly well detonated.

A good rule is to use a cap of a grade too strong than a grade too weak. The strongest cap is always best adapted to the longest hole, and is therefore the most economical.

It is customary to speak of caps as being of different degrees of strength. This is correct, but it means more than the mere mechanical force attained by different quantities of any particular detonating substance. It is the power or ability of that detonating substance by its peculiar dynamical and chemical nature to transform instantly an explosive into a state of great energy, and it has been shown in the early part of this paper that equal parts of some detonating substances possess this power immensely more than others.

Different brands of blasting caps contain different detonating mixtures, but they are supposed to be numbered or graded according to their detonating power, regardless of the weight of explosive which they contain. It was the custom in early days of dynamite to grade caps according to the weight of straight fulminate of mercury which they contained, because Nobel, the discoverer, found that a gun or rifle cap, which contained only half a grain of fulminate, would partially explode straight nitroglycerin, and that its explosive force was increased in proportion to the increased weight of fulminate up to 5 grains, which seemed to get the maximum energy out of this particular explosive. But other explosives required still more fulminate, some up to 30 grains or more, according to the length of charge to be detonated. Whenever fulminate of mercury is used, it must be incorporated with other ingredients to make the cap safe to handle. Some of these ingredients lessen its detonating effect, others intensify it, so the effects from given weights of fulminate have always been referred to as standards for different grades.

Though desirous of avoiding reference to any particular brand of caps, it is well to emphasize the fact that as their cost is small compared with the cost of drilling and preparing holes, none but the very strongest and best detonators should be employed. Consider first the powder and conditions under which it is to be used, then select a detonator which will develop the greatest energy out of that particular powder under those conditions. Properly made detonators, if not tampered with, should be safe to handle regardless of their strength.

Electrical fuses or exploders are for firing blasts by electricity. This method is of advantage when a number of shots can be fired simultaneously, as by firing them all at once the entire combined strength of the explosive is utilized. It is also commendable because of its safety and certainty of action in submarine work, wet shafts and other places. Electrical fuses are built into the blasting caps and form a part of them. (Fig. 3). They are sealed up air tight, and are as nearly water-proof as such things can be made without expensive rubber insulation; but when handled with ordinary care may be used freely under water, except when very deep, in which case they require special insulation and reinforced cartridges.

MISFIRES AND HOW TO AVOID THEM.

No blasting cap, unless it be a wet one, will fail to explode if fire reaches it, and there is no reason why the fire should not reach it if the fuse is good and has been properly handled. Nevertheless cap manufacturers, like other manufacturers, are blamed for failures in blasting and are called upon to investigate complaints, but, as a rule, the difficulties are traced to improper handling by the operator, generally unintentionally, sometimes through lack of proper instructions.

Caps have failed to explode, although the fuse had apparently burned all right. Upon investigation it has invariably been found that the fuse had not been put all the way into the cap and it had been crimped hard near the end with one or other of the objectionable tools which made a groove around the shell and had choked the fire in the fuse so that it could not spit into the cap. (Fig. 4.) Upon removing the old fuse and putting a fresh piece into the same caps which had failed before, but crimping them with a broad-face tool, every one has exploded. Hence, to avoid choking the fire in the fuse, al-

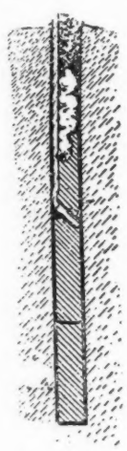


FIG. 11

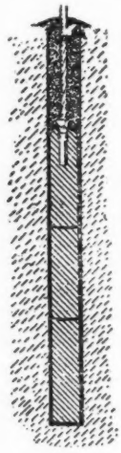


FIG. 12

ways see that the fuse is pushed down into the cap as far as the composition and secured to the cap with a broad tool, making a flat compression around the shell. (Fig. 5.) Avoid thin crimpers, which make a groove around the shell. (Fig. 6.)

GOOD CRIMPING DESIRABLE.

Why does a tool which makes a groove around the shell frequently choke the fire in the fuse, or cause the fire instead of spitting into the cap to break out through the fuse just above the cap? (Fig. 6.)

The familiar Chinese fire cracker will serve as an illustration. It is a core of meal powder rolled up in many layers of paper and choked at the bottom. The burning powder reaches this choke and can get no farther, so it takes the line of least resistance, bursts through the side of the paper and makes the desired report. So it is with fuse; the choke weakens or stops the fire, according to how hard it is crimped and how near the choke is to the extreme end of the fuse. A broad crimper (Fig. 7) cannot choke the fire because it acts similarily to a vise, and any good fuse will burn through a pressure of 300 pounds in a vise.

There are a great many more tools on the market which have the thin crimping part than have the broad. The thin ones (Fig. 8) have been cheaper to get up, hence find a market, but invariably wherever replaced by a broad tool the most frequent source of misfiring has ceased. Why buy a poor tool and take such chances when 50c. at most will buy a better and more practical tool?

Miners should be cautioned also about some combination crimpers and fuse cutters, because although many have the broad crimper, in some it is placed behind the cutting part. This is not a good ar-

FIG. 13

rangement because the cutter comes in the most convenient place to nip the cap with when in a hurry and being sharp, not only makes a groove part way around the shell but also breaks the shell and lets water into the cap. Bad results have been traced to this very thing; hence operators desiring combination tools should be particular to use only those which have the cutter behind the crimping part. (Fig. 9.)

When the use of a crimper is suggested to some miners, or when they hear of misfiring being caused by poor crimpers, they smile and tell how they get along by merely biting the cap to the fuse with their teeth. This is a crude method, but a positive admission of the necessity of fastening caps some way, or else these fellows would not take such a risk of putting dangerous things in their mouths. They also admit of occasional misfires due to caps slipping away from the fuse when they didn't bite hard enough, perhaps, and all are familiar with "miners' headaches," taking them as a matter of course, even after losing time waiting for noxious gases to clear after firing; hence these blasters have all this time unconsciously not been getting the best results out of caps and powder, because good crimping not only secures the position of the cap and keeps dampness out, but also serves as additional confinement to the fulminate, thereby developing greater power from the cap, which, as has already been shown, produced a corespondingly increased result from the powder.

PROPER CARE OF FUSE.

Other instances of complaint have been noted where the end of the fuse inserted in the cap had become damp. It had burned apparently down to the cap, but in so doing had forced the hot moisture into the cap, thereby not only moistening the fulminate but weakening the spit of the fire from the fuse. Damp fuse has been observed to burn a few feet and then slow down or hang fire and sometimes to go out. Cutting off the burned part immediately and relighting, the remainder burned a few inches and again went out, and so on through the whole length, showing conclusively that the heated dampness steamed the powder enough to weaken and at times to put out the fire. The remedy is as follows: Fuse should not be left lying around in a damp place; but if it has had to be for a short while, cut off a few inches and throw the piece away, or, having cut off the desired length for the whole, always put the freshly cut end into the cap. Of course, caps must be kept dry also.

The question has been asked, "Why should fuse so well protected with waterproof covering dampen so readily?" Because the meal powder in the fuse is very hygroscopic, drawing moisture from the atmosphere. Also, the yarn core along which the powder is strung is very dry and spongy, so that both the powder and yarn will draw moisture a long way into the fuse.

That this moisture is driven ahead of the fire in the fuse, steaming and weakening it, has been demonstrated in still another way by placing one end of the damp fuse in a cold glass tube and observing the large amount of water vapor condensed in the cold tube. Dry fuse will spit fire several inches into the tube and

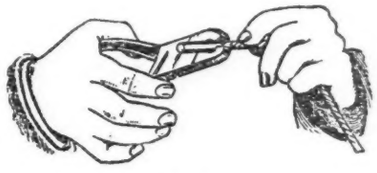


FIG. 14

the glass will be comparatively free from water, but damp fuse will only spit very weak fire, if any at all, and the cold glass tube will be wet with drops of condensed steam from the fuse, the amount of moisture increasing with the length of fuse burned.

In other instances blasters have smeared double-tape fuse with vaseline, others with axle grease or crude oil, when working in wet ground, intending to make it water-proof, and these oils being solvents of tar had penetrated through the tar into the core of powder in the fuse and spoiled it. The quantity of volatile tar products from the burning fuse may also be observed in the glass tube mentioned above by a brown stain which their condensation will make. Soap, clay or tallow will protect the fuse for a short time, but these occasionally get chafed off when pushed into the hole or during tamping. Candle grease is often used and is efficient, but care must be taken not to apply it too hot. The safer and better way in such cases is to use triple-tape or other water-proof fuse in wet ground, and secure the cap with a broad crimper, or wrap about four inches of electricians' adhesive tape over the junction of cap and fuse. (Fig. 10.) In very wet ground it is often expedient to use electrical exploders. (Fig. 3.)

PROCURING A COMPLETE DETONATION.

Unbottomed holes, "stinkers" and premature blasts are sometimes complained of. These have been found to be cases either of (1) using too low a grade of cap for a particular kind of powder, (2) spoiled powder, (3) uncareful loading, or (4) hole cut off by a previous shot. The proper choice of detonator will remedy the first cause: 3X or 4X caps are recommended for straight dynamites when not frozen; 5X, 6X or Lions for gelatin dynamites, chlorate mixtures and all other inert powders. In cold weather, nitroglycerin powders become less sensitive; the shortest cap is then especially recommended as it will get most work and least fumes out of any powder, even under favorable conditions.

The second cause requires more careful storage of powder. Nitroglycerin evaporates perceptibly at a temperature of 110 deg. F., so that the powder will become weakened and somewhat inert. It freezes at about 42 deg. F., becoming hard, inert and dangerous. In a damp place it will absorb moisture, which displaces the nitroglycerin, and if stored there for any length of time will spoil. Hence dynamite should be soft and dry, stored in a dry and cool place, with the cases placed so that the sticks of powder lie flat—not on end.

As for the third cause, premature blasts, smoky blasts and weak shots frequently result when the cap is buried way down in the mass of the charge, because the fuse in burning down, and before reaching the cap, may prematurely ignite the powder by side spitting or even by its own heat, and burn up part of it before the rest explodes. (Fig. 11) Even in preparing a short piece of cartridge as a primer it is bad practice to push any of the fuse into the powder, especially if it is cotton covered, as this adsorbs nitroglycerin rapidly, which, if injected into the cap, greatly weakens its explosive force, and sometimes causes misfire.

FIG. 15

Side spitting is not always the fault of the fuse. In rough handling it may have become kinked and the tape cracked or weakened at that place, so that it blows out of the side of the fuse. Hence, never bury a cap and fuse beneath several sticks of powder. The cap must, however, be in actual contact with the powder, hence the advisability of always tying the cap and fuse into the last stick of powder placed in the hole (Fig. 12), so that the powder cannot slip away from the cap, in which event there would either be atmping or an air space between the cap and charge, both of

which cause mis-shots or bad fumes in the mine, because when the cap gets separated from the powder it cannot possibly exercise its full detonating effect.

SUGGESTIONS TO INSURE BEST RESULTS IN BLASTING.

In view of the importance of the facts which have been brought forward, a summary is offered, not with the desire to dictate hard and fast rules to those who are breaking ground nearly every day of their lives, but in the form of brief and specific suggestions to insure more thorough detonations of powder and best results.

First—Select the right fuse for the kind of work, and proper caps for the kind of powder in use, and see that both are thoroughly dry.

Second—Powder must not get shaken out from end of fuse, nor sawdust or other obstruction get in between fuse and cap composition. Cutting fuse slanting not only allows a little of the powder to shake off, but often makes an obstruction to the fire because the slender end may fold under. (Fig. 13.) Also a sharp-pointed piece of fuse is not a desirable thing to thrust into any cap.

Third—Cut the fuse straight across, not slanting, and push it into the cap half an inch or more, all the way down to the powder. (Fig. 5.) If the fuse be ragged at the end or too large to enter the cap easily, never peel off any of the tape or yarn, but swage the end of the fuse to the proper size. This may be easily and quickly done by twisting and squeezing the large part with the crimper (Fig. 14), if it be a broad one. Having inserted the fuse, squeeze the shell tightly to it with a broad crimper placed around the shell so that one side just overlaps onto the fuse. This will make a compression about a quarter of an inch wide around the extreme upper end of the shell.

Fourth—The blasting powder should not be cold, much less frozen, and holes should be carefully charged, squeezing each cartridge separately with a wooden rammer so as to fill the hole completely to the desired hight.

Fifth—Having crimped the cap securely to the fuse, insert all of the cap—but none of the fuse—into a stick of powder and tie together (Fig. 15); then put this priming stick upon the rest of the powder in the hole (Fig. 12) and do not ram it until some loose sand or other tamping has been put in. Use tamping without any sharp rocks in it so as not to damage the fuse.

Sixth—Wherever a whole blast may be fired at once, and for all work in very wet places, electrical fuses will be found of advantage.

In conclusion, it is hoped that the subject of detonation as applied to the common blasting explosives has been made more clear and that the facts which have been brought forward show how detonating caps determine the value of the blasting powder which they are used with, and also that oftentimes the fuse, caps and powder are unjustly blamed, whereas if the operator attended more closely to the apparently insignificant but very essential details referred to, many fruitful sources of danger, as well as much trouble, worry and expense would be avoided.

I trust that a discussion of this paper will serve to elicit further information concerning the value and abuses of blasting powder, caps and accessories—or failures in which these may have had a part—from those of you who are acquainted with their employment. A record of such experience would be a welcome contribution to the good of our fellow miners.

California Petroleum

SPECIAL CORRESPONDENCE

The Union Oil Company of California has paid dividends to date of $2,225,000, so some oil companies are profitable after all. Lyman Stewart, the president of the company, in a letter to the stockholders, says: "For more than a year a large amount of the company's production has been restricted, owing to the lack of water transportation. This condition is now in a measure relieved and will soon be fully relieved. The steamship 'Lansing,' one of the six vessels which the company purchased last winter, is now in commission carrying oil on this coast, and the steamer 'Santa Rosa,' another of the vessels purchased, is now on the way to this coast, and her sister ship, the 'Santa Rita,' is expected westward within the next month. The aggregate carrying capacity of these vessels is nearly 150,000 barrels of oil. These, added to the fleet of vessels already in commission along the Pacific coast, will give the company substantial relief. The isthmian pipe-line is nearing completion and will furnish an outlet for all the oil for which the company can provide water transportation. With these enlarged facilities for transporting and marketing oil, the company's wells, many of which have been shut in, can be reopened, thereby very largely increasing the company's income. Notwithstanding the unsatisfactory market conditions which have prevailed, the company has many million barrels of oil sold for future delivery at satisfactory prices and assurance of the sale of many millions more through the isthmian line and in South America at even more remunerative prices."

The relative merits of fluorspar and limestone as fluxes in the iron-melting furnace are in dispute. It is acknowledged that fluorspar is superior in its fluxing qualities, but the principal objection to its use is its comparatively high cost. At present the only large supply of fluorspar in the United States comes from the Mississippi valley in Kentucky and Illinois.

The Slag Cement Plants

The Universal Portland Cement Company, a new subsidiary company of the United States Steel Corporation took over the plants and business of the cement department of the Illinois Steel Company, Oct. 1, and will continue the manufacture of "Universal" portland cement. Edward M. Hagar, who has for six years been manager of the cement department of the Illinois Steel Company, will be president of the new company, with headquarters in the Rookery building, Chicago. A Pittsburg office will also be opened. The present output of 6500 bbl. a day at South Chicago, Ill., and Buffington, Ind., is being increased by a new plant at Buffington, with a capacity of 6000 bbl. a day and a plant at Universal, Penn., near Pittsburg, to have a capacity of 4500 bbl. a day. When the new plants are in operation in the summer of 1907 the total output of the company will be 17,000 bbl. a day. The cement manufactured in the new mills as well as the old, will be made from slag and limestone by the same special process and under the same supervision which has been employed since 1900.

Both the new plants will be driven entirely by electric power from generators connected to gas engines using blast-furnace gases. The power will be transmitted 10 miles to Buffington from South Chicago at 22,000 volts from two 2000-kw. generators located at the south works of the Illinois Steel Company, from which point the supply of slag will be obtained. For the plant at Universal, Penn., near North Bessemer, the power will be transmitted seven miles from two 2000-kw. gas-engine-generator units at the Carrie furnaces, Homestead works of the Carnegie Steel Company, which furnaces will also supply the slag.

The Krupp Works, Germany

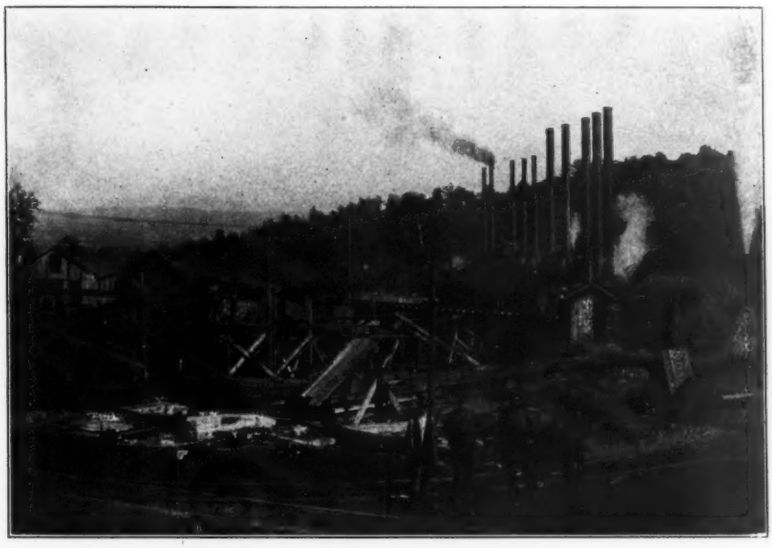
According to Consul-General Guenther, the celebrated works of Krupp at Essen, Magdeburg, Kiel, and Annen, and at their ore and coal mines had, on April 1, 1906, in their employ 62,553 persons of whom 5065 were officials and clerks against a total of 55,816 employees in the year before. The company's principal plant and accessories at Essen consumed as much water in said year as did the entire city of Dresden, which latter has a population of over 400,000 inhabitants. The gas made and consumed by the single cast-steel plant at Essen exceeds the gas consumption of the city of Elberfeld. Besides this, the electric plant of said cast-steel works supplies 1651 arc lamps, 15,304 incandescent lamps, and 763 electric motors. The average daily wages paid in 1905 to the workers in the cast-steel plant was $1.22 per person, which is about 5½c. more than was paid in the previous year.

MINING IN THE GEORGE'S CREEK COALFIELD

Unique Methods Employed by the Consolidation Coal Company

BY F. W. PARSONS

The George's Creek coalfield is contained in a deep, broad syncline, approximately 20 miles long, and five miles wide. The eastern portion is bounded by the Dans-Little Allegheny mountain belt, while on the west lies Big Savage mountain. North and South it extends from the Maryland-Pennsylvania line to the Potomac river.



PART OF SURFACE PLANT, OCEAN NO. 7 MINE

Before the Revolution, this region was included in the territory whose possession was in dispute between English and French. As a consequence, the country was mostly uninhabited until after the war, for which reason few land titles antedate the Revolution. The larger number of titles were for "Soldier Lots," 50-acre tracts, granted by Congress to men who had served during the Revolution. The system of establishing boundary lines was so irregular and inaccurate that much confusion and considerable litigation has resulted, even up to the present.

HISTORICAL

The exact date of the discovery of coal in the George's Creek field is not known, but as early as 1825, there was considerable mining, the coal being hauled to Cumberland in wagons and here loaded on flat-boats which carried it down the Potomac. Spring was the boating season; the boats were sold when they reached their destination and the crew returned afoot.

The Baltimore & Ohio Railroad was completed to Cumberland in 1842, which caused increased activity in coal mining throughout the region. The Maryland Mining Company was the first chartered company in the region; its organization dated back to 1828. The most important mine in the district at this time was the Eckhart. This plant is still in operation, and, although at one time abandoned, it has recently been reopened, and is now averaging more than 500 tons per day. The work consists entirely in robbing pillars, which will extend the life of the mine many years.

OCEAN NO. 7 TIPPLE, SHOWING SWITCH ENGINE

Early in the history of this field, an interesting experiment was conducted. This consisted in constructing a flume from Vale Summit to Clarysville for the transportation of coal by means of a stream of water. The coal was so much broken by this operation that the plan had to be abandoned.

The first important effort to combine mining interests was effected in 1864 when the Consolidation Coal Company, of Maryland, was organized and incorporated. The Frostburg Mining Company, Ocean Steam Coal Company, and Mt. Savage Iron Company were included. The Cumberland & Pennsylvania Railroad also came under control of the Consolidation company at this time, which gave the coal company excellent transportation to the Baltimore & Ohio Railroad at Piedmont. In 1872 the Pennsylvania Railroad built a branch road and competed with the Baltimore & Ohio for a share of the coal tonnage. To counter this move the Baltimore & Ohio in 1877 bought a controlling interest in the Consolidation Coal Company, the largest shipper; this interest it retained until early in the present year when, because of legislative action which promised to be adverse to railroads controlling mining companies, its shares were disposed of to friendly interests.

LABOR

There are few mining districts more pleasantly located than the George's Creek coalfield. The miners are of superior intelligence, mostly Americans; they are neither transient nor lawless, but are industrious and mostly property owners. The stranger entering Frostburg is immediately impressed by the neatness of the houses and grounds; there are few culm piles and no coke ovens.

The usual labor difficulties have been endured in this region as elsewhere. The first strike, lasting six months, took place in 1882; the miners were unsuccessful, just as they have been in each succeeding strike since then. During these early labor troubles many Germans and Swedes

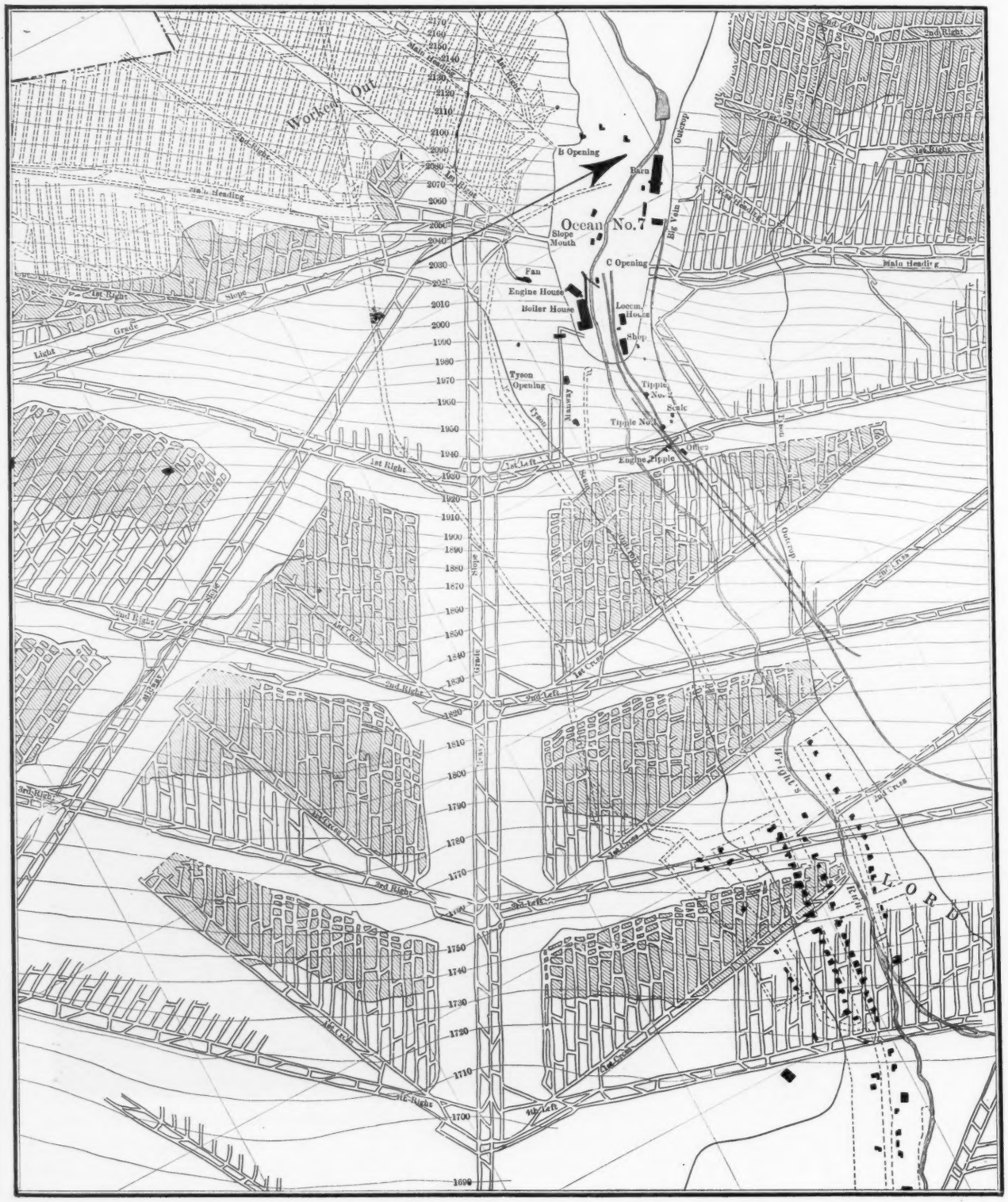
were brought in to help break the strike, and it is interesting to note that the men of these nationalities showed a tendency to remain miners only long enough to accumulate sufficient money to purchase farms.

The miners in the George's Creek field are paid about 50 per cent. more per ton than the miners in Indiana and Illinois. In the latter States, however, shooting the coal from the solid is much practised and permitted, which reduces the cost of mining. One other great advantage the miners in this field possess is their freedom to deal where they please, and not at a company store.

GEOLOGY

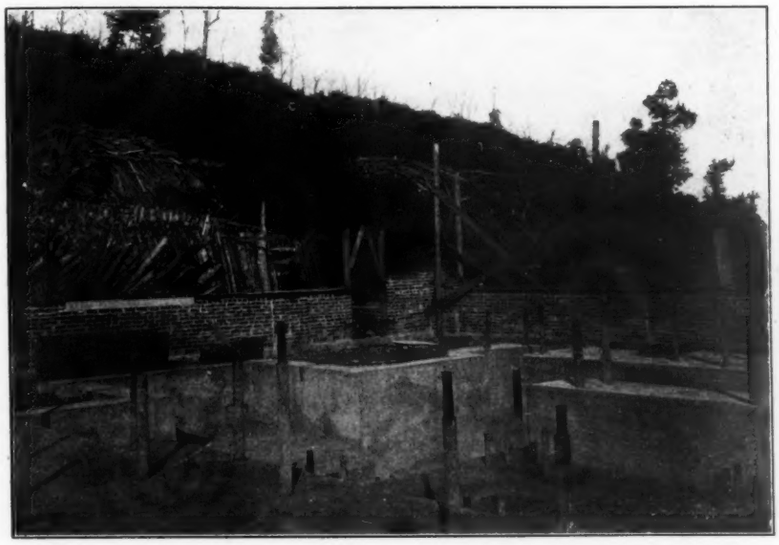
The excellent quality and desirable location of the Pittsburg or "Big Vein" seam, have made this coal the one the most generally worked, although the Conemaugh and Allegheny coals which underlie the Pittsburg seam, cover much greater areas than the "Big Vein." In the main part of the field, the Bakerstown, Upper Freeport, and Lower Kittanning seams are so located that they can mostly be worked by drifting.

Those who have studied the deposits and fossils throughout this field



PORTION OF OCEAN NO. 7 MINE

are satisfied that the seams are but a continuance of the coal beds of Pennsylvania and West Virginia. The faunal and floral characteristics here shown are so clearly marked, that little doubt concerning the horizons of the several seams can remain. In the lower formation, the identity of the Maryland beds



FOUNDATION SETTING FOR NEW DIRECT ACTION HOISTING ENGINE

with those of the Pennsylvania and West Virginia can be traced by the actual continuity of the seams. As to the early geology of these measures, there is little doubt that the region was at one time entirely submerged; the marine fossils and sandstones confirm such a theory. As the continent rose, the waters were drained, finally becoming a great inland sea. Later and more marked upheavals transformed the land into a broad rolling plateau.

NATURE OF THE COAL

Since the Georges Creek coalfield was first opened, there have been more than 125,000,000 tons of coal mined. More than 90 per cent. of this has come from the Pittsburg or "Big Vein" seam. This latter coal bed will average about 14 ft. thick, although but 8 ft. of this coal is worked. Above this workable coal is what is locally called the "Rashing," which is left in to act as roof for the rooms and entries. Whether this inferior coal will ever be recovered is doubtful, for robbing is extensively going on throughout the field, and the overlying cover is being allowed to come down as the work retreats. There are no washeries in this field, and in many places the coal is not even run over a domestic screen, but is loaded for shipment as run-of-mine. As a steam and smithing coal there are few fields in the world that can produce a better fuel.

The reputation deservedly attained by the George's creek coal can readily be surmised when it is known that this coal, in the face of all competition and high transportation rates, is carried to the most distant corners of the United States, if not of the world. For smithing purposes the coal is run over a 1¾-in. screen; the oversize goes for steam-making, while the undersize is loaded into sacks or box cars for shipment to points as far distant as Seattle and San Francisco. The reason for loading some of the coal in sacks is to make it convenient for overland haul from railroad points to places distant from railroads.

OCEAN NO. 7 MINE.

In describing the general method of working this coal, I will first take up the system used in the Ocean No. 7 mine of the Consolidation Coal Company. This mine is one of the most remarkable properties in the world. It is located at Lord, five miles from Frostburg; was opened in August, 1897, and has produced, from one opening, 4850 long tons in 10 hours. In 1905 this mine produced 1,036,000 long tons, a record probably not equaled by any bituminous mine, having but one opening, in the world. This record is the more remarkable when it is remembered that, except on the main slope, all haulage is performed by mules. As to whether the coal can be mined as cheaply in this primitive way as it could with electrical or compressed-air haulage, is a question that could be decided only after most careful study. One fact is most evident, and that is that the accident record of this mine can hardly be equaled by any other large coal mine in the country.

The pitch of the coal in this mine, and generally throughout the field, is about S. 60 deg. E. There is neither face nor butt to the coal, while absence of cleavage permits its being worked in whatever direction may be desired. The seam is here about 13 or 14 ft. thick, but, as before stated, only 8 ft. is worked, the "rashing" above this being left in for roof. The main slope entering the mine has a dip varying from 5 to 12 per cent. Tail-rope haulage is used for hoisting the coal up this grade and for letting the empties down. The main slope is more than a mile long, and runs almost directly to the dip. There are two other slopes as shown in the mine map here produced; the second slope runs counter to the dip, while the third slope is nearly level, almost following the strike of the seam.

HAULAGE AND VENTILATION.

Rope haulage is used on all these slopes, the engine being located on the surface, and operating a 1⅛-in. wire rope on a double drum. A ¾-in. tail rope is used for pulling the cars into the mines. On the main slope this tail rope is de-

OPENING OCEAN NO. 7 MINE

tached, the grade on this slope being sufficiently heavy for the empty cars going down to pull the hoisting rope in with them. About 20 cars are pulled up the steep slope every trip, while as many as 30 cars are pulled on the more level haulway. The cars from the rooms and cross entries are all brought to the main slopes

SLOPE AT OCEAN NO. 7 MINE

by large mules, the seam being high enough to permit their standing erect. Although conditions at this mine are as favorable to mule haulage as it is possible to be, the establishment of a plant for furnishing either electrical power or compressed air is certainly worthy of careful attention.

For ventilating the workings at this mine, there are two direct-connected Guibal fans with spiral casings. The larger fan is of 25 ft. diameter while the smaller is but 12 ft. The construction is so arranged that either or both fans can be reversed, and used as blowers.

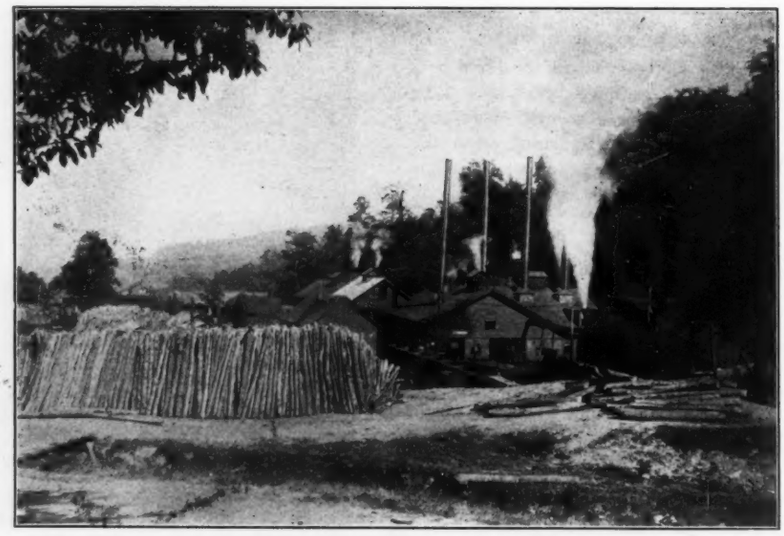
COAL SHIPPING

All the coal coming from this mine, as well as from the other mines in this field, receives but the simplest treatment on the surface. There are no washeries, practically no coke ovens and much of the coal is not even screened, being dumped into the railroad car direct and shipped as run-of-mine. At Ocean No. 7, the main tipple is so arranged that lump, nut, and slack coal can be separated and loaded at the same time. The coal when dumped from the mine car at the tipple passes over a bar screen which allows the nut and slack coal to fall through onto a second screen which separates the nut from the slack. Three cars are loaded at one time by this method. When it is desired to load run-of-mine, the upper screen is covered and there is consequently no separation.

MINING SYSTEM

In working the Ocean No. 7 mine, the system is particularly interesting because it differs from the general method used in other fields. There is little difficulty encountered in handling the water in this mine. A drainage tunnel has been driven through the center of the coal basin, emptying into George's creek near Midland. This tunnel was driven water-level so that all the mines are nearly self-draining. The map of Ocean No. 7 mine shows very plainly what exceptional care and precision the managers have exercised in development. It is important to emphasize in this connection the great difference that exists in mine maps. Although such a map is supposed to be a correct plan of the underground workings, the fact remains that many maps are entirely untrue and misleading. Not more than 50 per cent. of the coal mines in this country drive their rooms on centers or even survey the rooms except to measure the distance from the entry to the room face. When such records are taken into the office, the rooms are all beautifully sketched on the map, appearing at perfect right angles to the entry and of uniform width. It has been my experience to examine a number of such maps, while underground all was confusion from crooked entries and rooms driven together. The map here produced, made from carefully plotted angles and side-notes in all entries and rooms, shows the uniformity of work in such a monster mine. All surface features are accurately located on the mine map and are tied to a base line and a complete system of triangulation. All surface and underground surveys are limited to a certain error of closure, and then balanced. A feature of the underground surveys is the system of levels from which coal contours are determined and drawn on the map. Tracings of the mine map are made and photographed, the negatives being then used for printing small maps for pocket use.

There has been but little change in the method of working adopted several years ago. The present management is endeavoring to drive all work square instead of on an oblique angle, as formerly. The reasons given are that where irregular pillars are left, the sharp points or corners on these pillars are lost in robbing the coal. Along the main slope, at intervals of 1000 ft., cross entries are turned off to the right and the left. These cross entries, or rights and lefts, as they are called, are driven about on the strike and nearly level. From the right and left entries are



HOFFMAN MINE, OWNED BY CONSOLIDATED COAL COMPANY

driven other cross entries every 1200 ft., making an angle of about 25 deg. with the right and left entries. From these oblique entries, rooms are driven to the rise and nearly parallel with the main slope. About 25 rooms are turned off these oblique entries, the No. 1 room being about 800 ft. long, while room No. 25 is not much more than 100 ft. long. None of these rooms breaks through into the entry ahead, but instead a pillar varying from 100 to 200 ft. is left to protect the right or left entry above. Between room No. 1 and the main slope a 250-ft. pillar is left, which insures protection for this main haulway. If this system could only be studied by all the mining men who persistently claim that a mine cannot be properly ventilated unless every third or fourth room is broken into the entry above, certainly a change of opinion would ensue.

One peculiar and interesting method is practised in this mine. The first and the third oblique cross entries are worked simultaneously, while the second oblique cross entry is worked after the other two are completed. The advantage claimed for this system is that the cost of the room coal is always the same; the coal in the first oblique cross entry is cheap because of the short haul, while the coal from the third cross has a longer haul and increases the average cost of the two coals. The coal from the second cross, which lies between the first and the third, costs the same as the average of the other two.

The rooms throughout this mine are driven about 13 ft. wide, with 65 ft. centers between rooms. The headings or entries are 8 ft. wide. A pillar averaging about 40 ft. is left between the entry and its air course. In robbing the pillars, the method is to begin at the face of room 25 on one of the oblique cross entries, and retreat toward room 1. Each panel is thus worked independently and any squeeze or accident is localized. The track in the room is laid along the rib so that the pillar coal can be loaded directly into the car. At right angles to the length of the room, and 15 ft. from the face, the pillar is cross-cut and then cross-cut again parallel with the room length. In this way each pillar is divided into 15-ft. squares and taken out in blocks of this size. As all the rooms are driven to the raise, it is necessary for the cars to be hauled to the room faces. From here out to the main slope, the grade favors the loaded car. Each car weighs 1700 lb. and carries 2¼ tons of coal. The miners are paid by the ton.

Many peculiar methods of mining are practised at some of the George's creek mines. At several mines, it is the custom to drive only every other room as the entries advance, the intermediate rooms being driven on the retreat and just before the pillar is robbed. Another is to drive only entries and narrow work until the property limits are reached and then drive the rooms and rob the pillars on the retreat. Those using this method get a greater percentage of coal, use less timber, and lose practically no iron. The mines in the George's creek field are almost entirely free from fire-damp, so that the maximum distance for cross-cuts permitted by law is secured. These breakthroughs are generally about 100 ft. apart. In robbing, much attention is paid to keeping the pillars in line so that the cover will break evenly and the pressure be relieved instead of being forced onto the adjacent pillars. Possibly not more than 30 per cent. of the George's creek coal is obtained on the advance work; the wisdom of this policy is shown in the rarity of squeezes. Nearly 14,000 long tons of coal have been extracted from one acre of the "Big Vein," which shows the immense production available. Of this large tonnage the coal mined from the entries and rooms is in better blocks and contains less slack than the coal broken by the weight of the cover in robbing pillars. A like consequence of this fact is that where the cover is light, more lump coal is secured.

HOFFMAN MINE.

At the Hoffman mine, the plant of which is here shown, the output is from 1200 to 2000 tons. The mine is entered by a slope, on which the cars are pulled by a wire rope winding on a 6-ft. drum and operated by a stationary engine. The slope is sufficient for the empties to pull the rope in with them to the bottom of the slope. Compressed-air haulage is most successfully used in this mine. Cars are distributed and gathered from the rooms by small compressed-air motors weighing about 1000 lb. Along the main haulways to the foot of the slope the cars are hauled by two compressed-air motors weighing about 30,000 lb. The compressed air used in the locomotives underground is at a pressure of 800 lb. per sq.in. The method of mining in the Hoffman mine is most conservative and satisfactory. Rooms are driven only about 14 ft. wide and large pillars are left. The greater percentage of the coal is secured on the retreat.

DRAINAGE.

The Hoffman mine, Ocean No. 1 and several mines in this basin have suffered considerable trouble due to the large quantities of water encountered. At the Hoffman mine a shaft was sunk and used for pumping from this mine. At the foot of the shaft were two large pumps capable of handling 4000 gal. per minute. More than a dozen other small pumps driven by compressed air were used in this mine and caused the operating company much expense. In order to do away with these costs, it was decided to drive a drainage tunnel from the middle of the basin, emptying near Clarysville. This work was begun in the summer of 1903 and finished the last of August, 1906. The tunnel is 40 ft. more than 2 miles long and was driven almost entirely in rock. The cost totaled nearly $150,000. The tunnel is now carrying about 3800 cu.ft. of water per minute; but is expected in time to handle from 8000 to 10,000 cu.ft. per minute. When the two faces met in driving the tunnel, the error of closure was less than 2 in. horizontally and vertically. A detailed description of the work done in completing this tunnel, including some costs, will be dealt with in a coming issue of the JOURNAL.

ANALYSIS OF THE COAL.

A careful analysis of several samples of coal taken from Ocean No. 7 mine (Big Vein) shows: Moisture, 0.55 per cent.; volatile matter, 19.47 per cent.; fixed carbon, 72.84 per cent.; ash, 6.40 per cent.; sulphur, 0.92 per cent. The calorimetric value of this coal is 14,114 B.t.u. In the Sewickley and Freeport seams the coal runs higher in ash, showing from 8 to 16 per cent. of it. There is also a falling off in the heating value, due to the lesser quantity of fixed carbon. However, these smaller seams of coal will soon all be worked and will prove a source of great profit to the operating companies. The extensive working of these coals will mean the advent of the coal washery, which will in a way change the appearance and modify the methods now used. Were all of our coalfields as carefully managed and as systematically worked as the George's Creek region, there would be fewer accidents to life and property, cleaner towns and happier, more intelligent miners.

Colliery Notes

The more progressive coal companies are now running careful levels through all their mines, and from the elevations found, they are determining and placing contours on their maps, thus showing the general roll of the coal.

In shaft work, electricity should be used for firing dynamite. The battery for this purpose should be on the surface, and the wires conducting the current into the shaft should never be connected with the battery until all the men have left the shaft and reached a point of safety. In lowering the charge into the shaft it should be placed in a bucket by itself, and the hoisting engineer notified, so that he will observe extra precaution.

Light iron and small ties should never be used on haulage roads where electric motors are run. It is seldom advisable to use any rails lighter than 30 lb. while 50-lb. steel is none too heavy where large motors running at a good rate of speed are used. Haulage roads should be well timbered and lagging used where the roof is frail. At points where the roadbed is soft, it should be corduroyed by laying the track ties close together. Under ordinary conditions track ties are laid 2 ft. from center to center.

Metallics

The ore from Butte, Mont., which is concentrated at the Washoe works is practically chalcocite, enargite and pyrite in a quartz and aluminous gangue.

Recent borings in New Caledonia have revealed the fact that the chromite deposits have been but slightly opened. Large deposits, not before touched, have been encountered in depth.

The shells of the rollers of the Huntington mill are apt to wear down from 1½ in. to ½ in., and then crack and come off; but if they are kept even, they last longer. Die rings wear down from 2 in. to ¾ in.

The secret of successful aluminum casting lies in not overheating the metal. Highly heated aluminum absorbs gases which are disengaged upon cooling, and, on the other hand, if it is not sufficiently fluid, air bubbles are formed.

A French engineer has reported the occurrence of valuable asbestos deposits in Monte San Vittore, Italy. The percentage of fibrous asbestos is said to exceed 5 per cent., while short fiber is present to the amount of one-quarter of the whole.

Professor Rossi, of Italy, proposes to save the waste of sulphur at the Sicilian mines, where, owing to the low grade of the ore, a considerable loss of sulphur occurs, by collecting it with carbon bisulphide in a specially constructed apparatus. The process is not yet established.

Siemens & Halske, of Berlin, have patented a process for hardening steel by the addition of tantalum, which is supposed to yield a metal harder and more ductile than the ordinary tool steel. The applicability of this process will be limited by the small supply of tantalum minerals.

The Tennessee Copper Company is now building a large sulphuric acid plant to utilize the waste gases from its blast furnaces. It is expected that this plant will be completed early next spring. The installation is of especial interest, because this will be the first plant anywhere in the world to manufacture sulphuric acid in connection with pyritic smelting.

When underfed, the Huntington mill becomes noisy, vibrates and rapidly wears itself out. Overfeeding reduces all sound to a rumble, until the belts break or come off, and the pulp packs in the center and along the screens and splashes over the sides. In a similar way the operation of a ball-mill should be regulated by the sound developed, it being noisy when underfed, and emitting only a rumble when overfed.

A new method for the preservation of wood, which is being investigated in Europe, is impregnation with molten sulphur. The degree to which the wood is impregnated varies according to the nature of the wood, the temperature and duration of the bath. The increase in weight may amount to from 30 to 35 per cent. when the process is conducted in an open receptacle, and 100 per cent. if it be done in a vacuum pan.

At the Washoe smelter, Anaconda, Mont., it has sometimes happened, as for example, after a shut-down, that the contents of the fore-hearth of a smelting furnace have become cooled. Directly after tapping the matte, and before the settler has again filled with slag, it has been warmed by blowing in compressed air, so as to bessemerize the molten matte still remaining in the settler. The reaction, being exothermic, serves to raise the temperature of the molten contents.

The mines at Crimora, Virginia, are practically the only producers of true manganese ores in the United States. On account of the strong demand for manganese ore, which is now supplied almost entirely by imports, it would seem that diligent search for it in the United States ought to be undertaken. As high-grade manganese ores are admitted free of duty, and as the largest consumption is in the East, a deposit, to be profitable, must be within easy reach of railroad facilities.

Several varieties of gypsum are found and used in this country. The ordinary form in plaster quarries is rock gypsum. Alabaster is a pure white, evenly crystallized gypsum, occasionally used for statuary. Selenite is the crystalline white, and almost transparent, gypsum that occurs frequently in small masses scattered through a deposit of rock gypsum. In certain Western States, gypsum earth or gypsite is found, which consists of an impure earthy form of gypsum. Deposits of gypsum sand are also found in the West, which are composed of fine grains of gypsum.

At a mine in southern Rhodesia, the Huntington mill was found to be a good inside amalgamator. Mercury was fed into it at the rate of about 2 oz. per hour, the regulation as to quantity and frequency being determined by the condition of the plate below, whether "moist" or "dry." Amalgam would accumulate in the bottom of the Huntington mill, especially just below the feed, and in the direction in which the rollers revolved. It would also adhere to the ironwork on the sides. The inside required cleaning out frequently; with rich ore every two or three days, but with low-grade ore only once a week or fortnight.

When aluminum is melted and lead is added in proportions greater than 10 per cent., the metals separate on cooling into three layers—lead, aluminum, and between them an alloy containing from 90 to 97 per cent. of aluminum. The alloys with 93, 95 and 98 per cent. have densities of 2740, 2674 and 2600 respectively, and melting points nearly the same as aluminum. Their color is similar to that of aluminum, but less lustrous, and all are malleable, softer than aluminum, being easily cut, and have a granular fracture. On remelting they become somewhat richer in lead, through a tendency to liquation. They do not oxidize in moist air nor at their melting points.

It is a peculiar function of a fan blower that instead of always delivering a fixed volume of air, regardless of requirements, it automatically increases the volume as the resistances are decreased. On the other hand, if the blower be in operation with a fairly free outlet, in excess of its capacity area, and that free area be decreased, the pressure produced will immediately rise, thus tending at once to overcome the increased resistance. Therefore, if a certain maximum pressure is known to be required, the fan may be so speeded as to give this at such times as the conditions demand; while at other times, when less pressure or volume of air is required, proper manipulation of the blast gate will economize power.

G. H. Blakemore, in a recent discussion before the Institution of Mining and Metallurgy, reported that in his experience hot blast has not been of the least commercial use in smelting copper ores carrying up to 20 per cent. sulphur, or any other class of sulphide copper ores. At the Great Cobar mine, he discontinued the use of hot blast about four years ago, and saved 14c. per ton of ore by doing so. The furnaces produced a better grade of matte, and ran faster on cold blast than they did on hot blast. The average sulphur of the Great Cobar ore was about 12 per cent. and the temperature of blast used was 500 to 600 deg. F. At the Nymagee mine, he stopped the use of hot blast, and increased the depth of the furnace from 5 ft. 6 in. of charge to 11 ft. 6 in. without reducing the grade of the matte. This change increased the smelting capacity of the furnace by 200 tons of ore per week.

Counting rehandled material twice, more than 13,000 tons are handled daily at the Washoe smelting works, Anaconda, Mont., by 13 compressed-air locomotives, 12 of which weigh 13 tons each, and one 21 tons. Each locomotive carries two storage tanks for its air supply, the air being taken from a pressure system of pipes laid conveniently to the tracks, and having stations at which the locomotive stops to get its air supply. This supply is carried at from 800 to 900 lb. pressure per square inch. A reducing valve between the storage tanks and the cylinder reduces the pressure to 150 lb. A fresh supply of air is taken at times ranging from 20 to 60 minutes. For this particular service, where the distances are short, and where the cars are frequently stopped and started, the compressed-air locomotives have been found most satisfactory for convenience, reliability and simplicity of operation. They have been in constant service since 1900, and have needed only the natural running repairs.

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Illustrated.

The Hill Iron Ore Lands

The announcement that the transfer of the Hill or Great Northern holdings on the Mesabi iron range in Minnesota to the United States Steel Corporation had been finally arranged, was not unexpected, though it has been long delayed. Ever since it became known that Mr. Hill would dispose of these lands only in a single block, it was apparent that the Steel Corporation was the only buyer able to handle so great a transaction. It was also evident that the Steel Corporation could not afford to allow these lands to pass into other hands, or to remain in a position where they might be secured by possibly rival interests. The conclusion of the deal was certain, only to be delayed by discussion of the details.

A little explanation of the position of these lands may be of service. The mines of the Mesabi range were originally served by two railroads. The Duluth & Iron Range, built by the Minnesota Iron Company, to carry ore from the Vermillion, extends from Duluth along the Lake shore to Two Harbors, then north and east to Tower and Ely, but it has a branch to Virginia and Eveleth, on the eastern end of the Mesabi. The Duluth, Missabe & Northern, built by the Rockefeller interests, runs from Duluth north to Wolf and Iron Junction, branching thence eastward to Virginia, Eveleth, Mountain Iron and Biwabik, and westward to Hibbing, formerly considered the western end of the Mesabi, though recent explorations are considerably extending the limits. Both these roads passed into the possession of the United States Steel Corporation, when it was organized. At a later date the Great Northern built a branch from its main line at Swan River, west of Duluth, northward to Hibbing, and thence eastward, around the northern side of the range, to Virginia.

To secure traffic for this branch, James J. Hill proceeded to acquire the lands on the northern side of the range, chiefly north of the large mines already opened. Some of these lands were proved, most of them unproved, but all of them within the known iron-bearing limits. Some leases have been made, all with provision that ore mined must be shipped over the Great Northern. The great body of the lands has been held, however, by Mr. Hill, or the Great Northern Company; and it is these lands which are now transferred. It is claimed that the ore contained in them will reach a total of 500,000,000 tons. Nothing like this quantity has been proved by actual boring or testing; but some good authorities believe that the quantity will be much greater.

The terms of the transfer seem sufficiently onerous. Only an outline of them has been made public, the details being merely indicated. The Steel Corporation takes the lands under a perpetual lease on a royalty basis, the lease payments to include transportation of the ore mined to Lake Superior docks. For the first year, 1907, the royalty is to be $1.65 per ton, with a minimum of 750,000 tons. The payment is understood to include 80c. for transportation, and 85c. for royalty on ore mined; the transportation charge being fixed, so that the royalty may be considered separately. It is understood that this is fixed on an agreed basis, which is probably for standard Mesabi bessemer, that is, ore carrying 55 to 60 per cent. iron, and not over 0.045 phosphorus. What allowances are to be made for lower-grade ores or for those over the bessemer limit in phosphorus, is not made public. The minimum quantity of ore to be mined—or paid for—is to increase by 750,000 tons each year, until 8,250,000 tons is reached; thereafter it is to remain at that figure. The royalty is to be increased by 3.4c., or 4 per cent., yearly, and this increase is, apparently, to go on indefinitely. Under these terms, in 1917, the Steel Corporation must mine at least 8,250,000 tons of ore, and the cost of that ore at the Lake docks will be $1.99 per ton *plus* the cost of mining and loading; that is, from $3 to $3.50 per ton in all, at the Lake.

Mr. Hill has contended for some time that Mesabi ore was worth $1 per ton in the mine; and he seems to have secured very nearly his price. This is, however, far above the the royalties paid on most Mesabi mines, the average on existing leases being between 30 and 35c. per ton. The transportation charge does not appear excessive. Taking the limits of the range, the average haul on Mesabi ore to the Lake is about 75 miles by the Duluth, Missabe & Northern to Duluth; 78 miles to Two Harbors, or 105 miles to Duluth by the Duluth & Iron Range; and 132 miles to Superior by the Great Northern. The 80c. rate by the latter, will give an average of not far from 0.66c. per ton-mile.

So much for the lease itself. The most important point about the whole matter is

that this transfer removes the possibility of any more serious competition for the Steel Corporation than now exists, for it takes out of the market the one large remaining block of iron ore in the ground. Speaking in a broad way, every ton of ore on the Mesabi is now the property of one or another of the various steel-making companies, and none of them can be led to sell any part of its holdings, or to dispose of any of its ore to outside steel makers. This means no more steel-making concerns until some other region, as favorably situated as the Mesabi, shall have been opened, and the chances for such a contingency are exceedingly remote. The Steel Corporation now has many times the amount of proved ore, and probably valuable ore lands, held by any other concern; far more, even in proportion to its production of iron and steel, than any. Therefore serious competition from any new source is eliminated, as well as severe and lasting competition from concerns now in existence. The word lasting is used in this connection to cover a considerable period of years. The only great bodies of ore now available are in the South, and those are entirely different from the Lake ores in character and conditions.

The Pocahontas Colliery Explosion

Another terrible explosion has been added to the long list of mining disasters in West Virginia. The loss of life and damage to property has not yet been definitely ascertained, but it is certain that they will be as bad as in any other similar calamity in that coalfield during recent years.

Increased interest and importance attaches itself to this explosion because on Nov. 22, 1901, this mine was the scene of a similar explosion, in which many men, including General Superintendent O'Malley and seven other rescuers, were killed. Since this first disaster, and up to the present time, the greatest precautions have been observed; new fans have been installed, substantial brattices have been built and the air has been carefully split at each cross-entry and carried over the main intake to the return airway by means of overcasts. In order to have the proper amount of air circulate through each panel or split, the general arrangement was to provide a regulator built of wood, with the size of opening in the regulator depending entirely on the amount of air needed in the panel. The regulators in each case were placed in the return airway, near the overcast.

It still remains for the mining engineers to learn the lesson taught by these explosions, to solve the problem and provide the remedy. Some questions are: Have we benefited in experience from the disasters that have happened? Do we not rescue men precisely as we did five or ten years ago? Do we not ventilate our mines almost exactly as we did then? Do our safety lamps differ, so far as the percentage of gas they will detect, from those used a decade ago?

No matter what progress some individual mine has made toward more approved and more modern methods, the industry as a whole has advanced but little.

Experiments proving the value of modern apparatus have been both numerous and successful, but mine managers, especially in America, have shown a stubborn reluctance toward the adoption of these improvements. There are practically no mines in this country supplied with safety lamps that will show caps when the percentage of gas in the air is less than 1½ or 2 per cent. Nevertheless, there are several lamps of proved worth that show tests when less than ½ per cent. of gas is present. In fact, an ordinary safety lamp burning a supply of absolute alcohol will show four times as fine a test as the same lamp will show when signal oil or some other vegetable oil is used. It is not so much the lamp as what is burned that determines the fineness of the test.

Another fact, plainly evident in nearly all our explosions is that the loss of life in rescuing the entombed is often greater than that caused by the initial explosion. Rescue apparatus can easily be obtained and has proved highly successful in European coal mines, but mine owners in this country have utterly neglected the procuring of such necessary apparatus, although many lives could undoubtedly have been saved by its use. At every mine in America there are scores of men ready and willing to take their places on a rescue party and walk hand in hand with death if only one of their brother workers can be saved. These men in many cases have families depending on them, and it is not right that they should be asked or even permitted to attempt such dangerous work without the greatest provision for their safety.

The Pocahontas mine lies in a district that will always be gassy, just as other districts in the New River and Pittsburg fields will always be dangerous. The managements of these mines are no more to blame than the managers and superintendents of other mines where disasters have not occurred. The conditions are different and the air circulating in the Pocahontas mine at the time of the explosion would have made the air-currents in many other properties seem woefully insufficient. The Capell direct-current fan at the Pocahontas mine is one of the best installations that exist in this country. It has a maximum voltage of 550 and is driven by a 200-h.p. motor. It circulates about 300,000 cu.ft. of air per minute and will pull 400,000 cu. ft. The Pocahontas West mine is not only the largest bituminous operation, but one of the ideal mines of America, being worked on a system that is almost irreproachable. Why is it, then, that such a mine should be subject to an accident so terrible?

In the first place, it must be recognized that if the system and method of mining employed in the Pocahontas West mine had been less efficient, the loss of life would have perhaps been more than trebled; in the second place, it must be borne in mind that the district is one where eternal vigilance must be observed; but with all due consideration to such extenuating conditions the conviction forces itself that our colliery people are almost absolutely ignorant—we do not like to say that they are also indifferent—to the causes and nature of mine explosions.

It is time that these questions, affecting the lives and welfare of so many people, should be studied with a view to minimizing the list of these frightful disasters, which so often appal us. Let the great coal-mining States unite in the appointment of an expert commission to investigate the causes and effects of mine explosions in their coalfields and recommend the best means for safeguarding against them; and then let their legislatures make uniform laws, with adequate provisions for their enforcement, that will make coal mining as safe as it can humanly be done; and let the Federal Government, as controller of coal mining in the Territories, co-operate in the investigation and in the formulation of suitable laws. We hope that this important subject will be freely discussed by our readers in the columns of the JOURNAL.

UNDERGROUND ORE HANDLING AT LAKE SUPERIOR

A Practical Discussion of the Methods at Wolverine and Mohawk Mines—A New System of Tramming—Analysis of Details and Costs

BY W. R. CRANE *

The handling of mine products is one of the difficult problems of mine management, and is often the first operation affected, when an effort is made to economize in the mining operations. The method of hoisting adopted and the distance between hoisting shafts, if more than one are used, have considerable to do in determining the system of underground handling employed. Further, the system of mining, which is the controlling factor in the choice of mine handling and haulage systems, is in turn determined largely by the kind and occurrence of the mineral deposit. Steeply pitching deposits require hand tramming unless very extensive, while flat or slightly pitching deposits must, of necessity, for large outputs, have some form of haulage system. In general, it may be said that, in vein or lode mining, hand-tramming is the rule, while with bedded deposits animal or mechanical haulage must be resorted to.

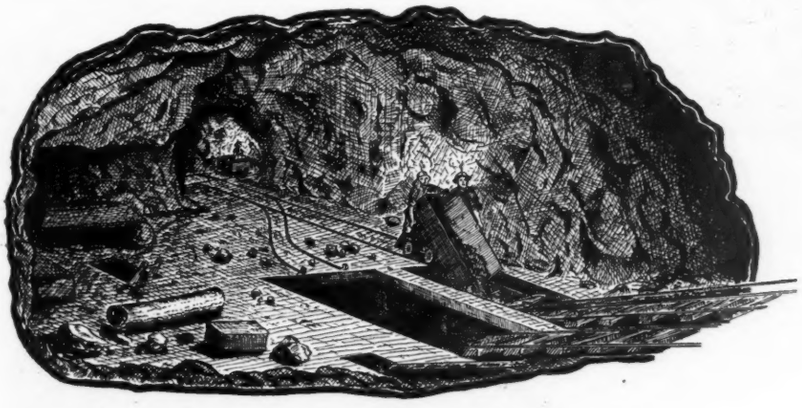

FIG. 1. LOADING A SKIP AT A STATION, WOLVERINE MINE.

Change in character and occurrence of mineral and in extent of mine workings often necessitates a change in handling, both in stopes and on levels. A change may then be made at any time during the life of a mine, but should not be attempted until thoroughly tried in some portion of the mine where average conditions prevail.

The following notes regarding the handling of copper rock, both in the mine and on the surface, especially the former, are taken from practice in the Wolverine and Mohawk mines on the Kearsarge lode, Keweenaw point, Mich.

To maintain uniform grades in the shafts it is often necessary, owing to variations in the pitch of the lode, to sink them part of their length in the footwall. When a shaft is sunk in the lode, the level tracks terminate at the sides of the shaft, but when sunk in the footwall, a crosscut is driven to the levels, thus making connection with the level tracks. The crosscut tracks then terminate at the front side of the shaft (see Fig. 1). Little difference results in the methods of handling cars in these two arrangements of shafts, except that a greater distance must be covered by the trammers in the latter, with a consequent loss of time; however, there are advantages in the crosscut over the other arrangement, such as the indiscriminate use of cars in the levels, on both sides of the shaft, and greater facility in handling cars at the shaft. Further, a skip standing on a track of slight inclination, even as high as 38 deg., does not readily fill when loaded from the back, owing to the slope of the bottom of the skip being practically equal to the angle of repose of the ore, while if loaded from the side this difficulty is largely obviated. There are various means employed in overcoming the difficulty of loading noted, other than loading from the side. At the Mohawk mine the bottom of the skips is permanently set at a greater angle than that of the shaft tracks, by raising the forward wheels; while in the Quincy mine, a steeper slope is given the skips by temporarily changing the grade of the shaft tracks at the loading stations, which does not, however, cause any inconvenience, as the usual grade is maintained by bridgings during hoisting.

The latest pattern of car, of which a large number are in use and many more are being built, is made of sheet iron having the following dimensions: Length 7 ft. hight 2 ft. 1⅜ in., and width 2 ft. 7½ in. The car has a capacity of 2½ tons, although the load usually handled does not exceed two tons. As the diameter of the car wheels is only 12 in., the bottom must of necessity come close to the ground, which is a positive advantage in loading. Further, one end of the car is open, which, when the car is tilted, rests upon the ground, the bottom forming an inclined plane, up which the large masses of rock are worked until loaded into the car.

The slope of the foootwall is such that the rock, when broken down by the blasting operations, usually runs to the foot of the stope. However, in certain stopes, where the pitch of the lode becomes slighter, it is often found necessary to assist gravity by placing shovelers in the stopes. Occasionally the rock must be shoveled as many as four or five times before the foot of the stope is reached and the rock is in position to be loaded into the cars standing on the level tracks. This is rather an expensive operation and may, in fact, become prohibitive on pitches as low as 30 deg. It is, however, the usual practice now to employ chutes on the stopes, where movement of rock becomes somewhat difficult (see Fig. 2). The chutes, used in the Mohawk mine, are made of ¼-in. sheet iron, are semicircular in form (2 ft. wide and 16 ft. long), and are supported on wooden horses and props, or, where they come near the floor of the stope, may be simply blocked up. The lower end is set at a hight such that rock thrown into the chute will discharge into a car standing beneath it on the level track. The chute is extended section by section as the hight of the stope increases, the ends of the respective sections overlapping. Sliding friction is thus reduced, a simple connection also being made. It is evident that any slope desirable may be given to the line of the chute, even giving different grades to the various sections, which is the usual arrangement adopted with the last one or two sections at the foot of the stope, in order that the velocity of the downward moving rock may be checked somewhat before entering the car.

Such a conveyor may be set up after the face of a stope has become cumbered with rock, in which case several shovelers are placed along the line of the chute. It is, however, usually considered better practice to keep the floor of the stope clean, advancing the chute as the face of the stope advances, the position of the shovelers being at the upper end of the chute. Further, the slope of the chute may be varied slightly by extending it diagonally across the pitch of the stope, by which it may be made to serve a considerable area of stope, being shifted first to one side, then to the other.

When shovelers are employed in moving the rock down the stopes, their wages must be added to the cost of handling, usually to the tramming cost. With

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chutes, however, the cost of handling rock over that where it moves itself, is simply the cost of the one or two extra shovelers, which may be partially offset by the reduction in number of trammers from three to two. As a usual thing, however, there are large masses of rock that must be loaded into the cars, and if too large, must be reduced to a size that will permit of loading. It is, therefore, usual to have at least three loaders and trammers, although where the rock breaks up well it is not necessary.

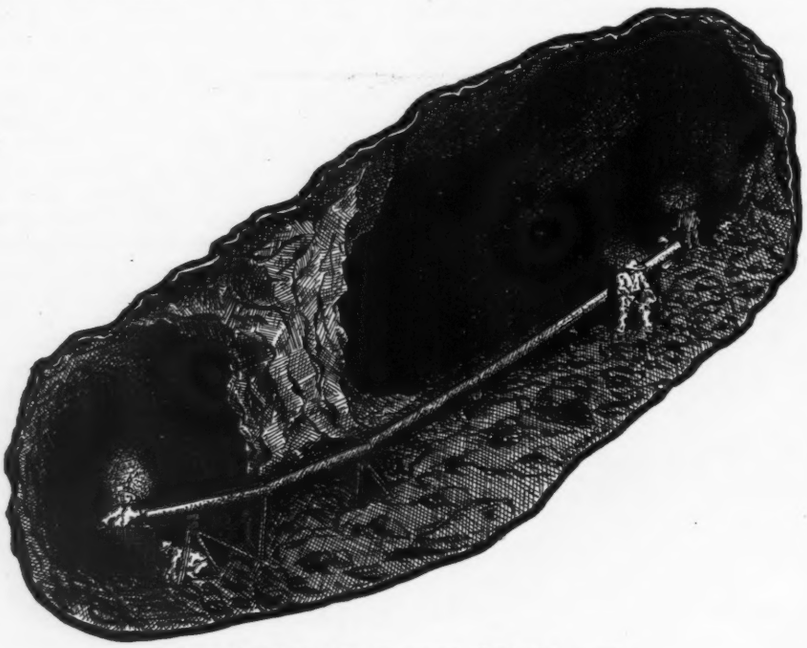

FIG. 2. LOADING CARS BY CHUTE, MOHAWK MINE

The system of handling cars between the stopes and shafts formerly the practice, but now employed only in part, at the Wolverine mine, consists in having the trammers act also as dumpers, i.e., loading the skips. There are from two to three trammers working on either side of a shaft on the same level, who load their cars at the stope, tram to the shaft and dump into the skip, and, if the skip is not there, wait for it to stop at their level in turn. It is evident that much time must of necessity be wasted by such a method of procedure; the holding of the skip at a given level, reached in order of hoisting from top to bottom, or bottom to top of mine, to receive its load, means a delay all along the line; or, if it passes to the next level in order, the crew of trammers, in the level passed, delayed by slowness or accident, would have to wait until the skip reached them again (a matter of an hour or more). Further, the delay would be for two crews, as there are two to each level. It is a rare occurrence, however, when the two crews on a level fail to have their cars at the landing ready for dumping at the required time; a delay of one crew means then a half load for the skip—a loss from any standpoint.

The management of the Wolverine mine, in an attempt to increase the efficiency of its tramming force, has introduced a new scheme, which, as indicated, has been adopted in part only, i.e., at shaft No. 4. The reason for not making an immediate change in system is that where only two or three cars were formerly required to a tramming crew, with the new system fully twice as many will be necessary. As the cars are made at the mine shops, their capacity not being great, the output is limited. The change in systems of underground handling of rock will then be made as rapidly as equipment will permit.

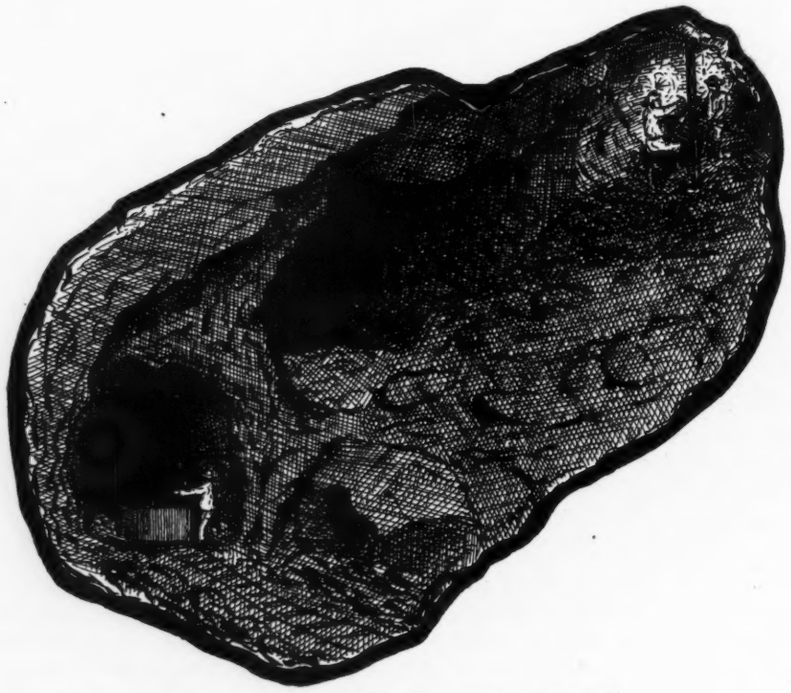

FIG. 3. RAISE STOPING, "BREAKING THROUGH"

In the new system, now employed at No. 4 shaft, there are two trammers to each side of a shaft to the level, whose duty it is to load the cars at the stope; each car as loaded is then trammed to the shaft station and an empty one immediately taken back to the stope. Double tracks are necessary to facilitate the handling of loaded and empty cars, which are provided by a branch being run parallel with the main track in the enlarged passages, or partings, at or near the station, or in the crosscuts (see Fig. 1). In this system it is a rare occurrence when two loaded cars are not available for filling the skip.

Aside from the tramming crews there is a dumping crew, only one to a shaft, however. It is the work of the dumpers, of which there are two or three men, to load the skip, beginning at the uppermost level at which mining is carried on and proceeding downward, a level at a time, until the bottom of the workings is reached. The dumpers take the loaded cars, left on the main track by the trammers, and return the empty ones to the switch, from which they are taken in turn by the trammers. The skips hold about 4½ tons, while the cars have a working capacity of two tons; consequently it takes two cars to fill a skip, which means that each tramming crew must load and deliver to the parting at least one car between stops of the skip at that station. Any delay in hoisting does not necessarily interfere with the trammers, as they have a reserve of cars from which to draw. An experience of several months has shown the system to work smoothly and save much time. The dumpers pass downward from station to station, by the manway, until the bottom of the workings has been reached, when they return to the top of the workings, in the

skip, proceeding downward again as before, and so on throughout the shift.

On signal the loaded skip is hoisted up the incline shaft, emerging from which it continues up a prolongation of the same to the shaft house, in which are located the grizzly and crushers. The oversize passing the grizzly, which is about 16 ft. square, consisting of twenty-two 3½-in. iron rods spaced 3½ in. apart, piles up on the floor directly in front of the crushers. On being shoveled to the crushers, which are 18x24 in., the broken rock enters the ore bin below, where it mixes with the undersize from the grizzly. The large pieces of rock are broken by sledges and wedges, while the masses of rock and copper that cannot be readily reduced by hand are carried by air hoist, operating on an overhead track, to an air hammer where they are broken up, the copper being thrown into the mass copper bin, the rock going to the crushers.

From the ore bin the rock is drawn into railway cars, having a capacity of 40 tons, and is hauled to the mill.

Data regarding tramming, including loading, tramming, amount of rock handled per shift, etc., are given in Table I.

and 19.9c. per ton of rock milled; in 1892 the costs for the Atantic, Osceola, and Kearsarge were, respectively, 24, 19.3, and 17.4c. per ton. Tramming costs for the Baltic mine, years 1902 and 1903, were 21.5 and 17.4c. respectively per ton milled. The cost of tramming probably changes less than most of the other underground operations although marked changes have been noted. However, the cost as figured for the Wolverine mine compares favorably with the others, if an average is struck—a cost of 15c. per ton, a trifle below the average, 17, is probably a fair estimate.

The handling of the materials excavated in shaft sinking is accomplished by a bucket operating on an aërial rope system. The sinking shaft is driven at one end of the sump of the main hoisting shaft, and is enlarged to the full size of the latter after a depth of 6 to 7 ft. has been reached, thus leaving a rock pentice for the protection of the operations below. The empty bucket is lowered and when filled is raised by an air hoist set in the station above.

Data regarding the handling of rock by this system are given in Table II.

TABLE I.

Observations.	Number of Trammers.	Distance Trammed in Feet.	Time Required to Tram from Shaft to Stope.	Time Required to Load Car.	Time Required to Tram from Stope to Shaft.	Total Time Required to Tram Load and Retram.	Cost per Ton of Rock Trammed, in Cents.	Tons Handled per Shift of 10 Hours 9 Hours Effective Work.
1	2	690	6′	20′	3′	29′	12.34	37.24
2	2	690	6′	18′	3′	27′	11.50	40.00
3	3	200	2′	37′	1′	40′	25.50	27.00
4	3	200	2′	40′	1′	43′	27.40	25.10
5	2	220	1′	13′	1′	15′	6.39	72.00
6	2	220	1′	28′	1′	30′	12.77	36.00
7	2	220	1′	14′	1′	16′	6.70	67.50
8	2	300	3′	55′	2′	60′	25.55	18 00
9	2	300	3′	45′	2′	50′	21.75	21.60
10	3	420	3′	38′	2½′	43½′	23.52	24 82
Average.	2.3	340	2.8′	30.8′	1.75′	35.3′	17.34	36.92

TABLE II.

Observations.	Time Required to Place Bucket.	Time Required to Fill Bucket.	Hoisting, Dumping, and Lowering Time.	Delays.	Total Time.	Capacity of Bucket in Tons.
1	40″	1′ 30″	1′ 45″	15″	3′ 02″	⅓
2	40″	3′ 20″	2′ 00″	10″	6′ 20″	⅓
3	40″	2′ 50″	1′ 50″	20″	5′ 40″	⅓
4	50″	2′ 50″	1′ 50″	10″	5′ 40″	⅓
5	30″	2′ 00″	1′ 30″	10″	4′ 10″	⅓
Average.	40″	2′ 30″	1′ 37″	13″	4′ 30″	⅓

Available data regarding cost of tramming in the Lake copper mines are difficult to get, especially of present practice. However, the following will serve as a means of comparison: In 1887 the costs of tramming in the Osceola and Tamarack mines were respectively 18.6

Hand tramming is the usual method of handling copper rock in the Michigan mines, although electricity is being introduced, and there is no reason why it should not come into general use in the larger mines. Hand tramming will, however, continue to be the method employed especially in preliminary work and until the workings have reached a point where mechanical haulage will be warrantable.

[Fig. 2 of this article was erroneously used with the article of last week, and it is here reproduced to explain the text of the present article.]

The American Mining Congress

As already announced, the meeting of the American Mining Congress will be held in Denver, Oct. 16-19. At opening session, addresses of welcome will be made by Governor McDonald, of Colorado, and Mayor Speer, of Denver; responses will be made by President Richards and other prominent members of the congress.

A number of papers have been promised for this meeting. The three more important, which are expected to call out prolonged discussion, are:

"Mine Drainage Districts," by D. W. Brunton, of Colorado.

"The Prevention of Mining Frauds by State Legislation," by Gov. George C. Pardee, of California.

"The Mutual Relations and Grievances of the Smelting Trust and the Ore Producer," by Senator E. A. De La Vergne, of Colorado.

Among other important papers announced are the following:

"Needed Legislation for the Protection of Forests." Lewis E. Aubury, State mineralogist of California.

"Recent Litigation Involving Questions of Damages from Smelter Fumes, Tailings Water and Tailings Débris." Prof. F. W. Traphagen, State School of Mines, Golden, Colo.

"Treatment of Ores in the Tonopah-Goldfield District." F. L. Bosqui, Goldfield, Nev.

"Amendments Advisable to State Mining Laws," by Wilson I. Snyder, Salt Lake City, Utah.

"The Advantages of a Free Qualitative Analysis Laboratory," by E. W. Martin, Deadwood, S. Dak.

"The Necessity and Advantages of a National Organization of Mining Men," by E. A. Colburn, president Colorado Mine Owners' Association, Denver.

Talc in France

France is becoming an important center for the output of talc, in block or in powder. Good white talc may be purchased at from $9 to $11 per metric ton, and a better quality is obtainable at $15 per ton, ready cleaned. It is used largely for burners of acetylene gas jets, and a contract with an American firm has lately been closed here for 1000 tons at $40 per ton for this and similar purposes. France may now be considered the first European country for the output of talc, having overtaken Italy, which was long the largest producer.

The Giroux Hot Blast Furnace.

The National Metallurgical Company, of Matehuala, Mexico, is almost ready to put into service a new 42x160-in. blast furnace fitted with the hot-blast top invented by Jos. L. Giroux. This has been in use at the United Verde smelter for three years and is claimed to have proved a great source of fuel economy, besides showing that the design is entirely successful in resisting the destructive effects of expansion and contraction. The tops are also ready for use at the works of the Giroux Consolidated Mines Company, Ely, Nev., where they will furnish a blast heated to 400 or 500 deg. Fahrenheit.

The Giroux apparatus consists of two

View of Tubes

GIROUX BLAST FURNACE TOP

series of metal pipes arranged symmetrically around the inside of the top of the furnace, the lower ends of the pipes being just above the top of the charging floor. The vertical portion of the pipes is built of sheet steel. These are circular at the bottom, where they join the return elbows, and oval, and of larger section, at the top. Near their tops the pipes are connected in pairs sidewise by flanged cast-iron connections, and at the bottoms each pair of pipes is connected to form a continuous series on each side of the furnace by cast-iron return elbows. These elbows have a V-shaped section with one side of the V lying parallel with the side of the furnace top, and the other forming a slope for the hot-furnace gases to impinge against. This insures the distribution of the hot gases along the sides of the upright pipes.

The blast from the blower enters the furnace at the top of the attachment at the two ends. It then circulates through the heating pipes in series and passes down into the bustle pipe and to the tuyeres.

This heater was built by the Traylor Engineering Company, New York, and this company is now building another for a furnace 46x255 in. for the Dominion Copper Company, of Canada.

Cyanide Mills in Guanajuato

SPECIAL CORRESPONDENCE

The rapid and continuous strides which have been made in Mexico recently in the successful treatment of silver ores by the cyanide process have caused almost all the mills of Guanajuato to adopt the stamps and cyanide, and discard the old patio process, as well as to cease sending their products to the smelter, except in the case of the high-grade sulphide concentrates where concentration preceded the cyanidation as is done at the mill of the Guanajuato Consolidated. As a consequence the number of stamps falling in Guanajuato has given the greatest boom to the camp that it has ever known. There are dropping at the Guanajuato Consolidated 80 stamps; Guanajuato Reduction and Mines Company, 80 stamps; El Cubo, 100 stamps; Twentieth Century, 15 stamps; Nayal, 10 stamps and 10 more are being added; Central also 10, which will soon be added to, while at the Guanajuato Amalgamated gold mines, 100 stamps are being erected which it is hoped to have moving before November; at the Peregrinas the endeavor is to have 120 stamps dropping in October; at the San Prospero, 40 stamps are being put in position and will be added to as rapidly as possible; and likewise the Pinguico will soon have a large mill started for treating the fine orebodies being developed there. At the Cedro and Mizpah the changes are favorable for mills, as also at the Victoria if matters are adjusted there and operations are resumed, as the large stockholders are now talking of doing.

Labor in the Transvaal Mines

SPECIAL CORRESPONDENCE

After a lot of talk, on the part of the public, the government has consented to competitive recruiting of Kafir labor. Heretofore the recruiting has been in the hands of a monopoly, the Witwatersrand Native Labor Association. Any mine or group of mines can now send its own men to most parts of South Africa to recruit colored labor. The association still holds the monopoly of recruiting in the Transvaal. This free recruiting of Kafirs will not solve the labor difficulty. Competition will simply raise the price paid for Kafirs, and will not improve their efficiency.

Some miners are getting "Cape boys" from Cape Colony to make up the shortage of labor. These Cape boys are half-castes, and are numerous in the Colony. They are fair workmen, but are much more expensive than the Kafir, and not as efficient as the Chinese. The Cape boy is, as a rule, very intemperate. These laborers from the Colony will be put in the mine on contract, and will be able to earn from $1.75 to $2.25 per day.

People in Cape Colony are rather concerned at the probable exodus of Cape

Tubes Encased

GIROUX BLAST FURNACE TOP

boys to the Rand, for the farmers depend upon them as laborers. Of late there has been a steady influx of these half-castes into the towns, where they are not required. Once located in towns they cease to be farm laborers. Johannesburg is gradually getting an extensive and efficient electric tram service, which is run by the municipality. The power is supplied by gas engines, and when fully completed the plant will be the largest in the world. So far the power scheme has been far from satisfactory, serious break-downs being frequent. The champions of the gas plant are confident that all difficulties will eventually be overcome, and the scheme be made a success. The demand for power is far in excess of the supply.

CORRESPONDENCE

Discussions by Our Readers of Various Topics of Interest

The Piston Action of the Electric Air Drill

The practical information in the JOURNAL of Sept. 22 concerning the cost of operating the electric air drill seems to invite discussion of other features of it. The drill being new and as yet not fully known and understood, it may be considered proper to offer a little sketch of its construction and operation.

FIG. 1. VIEW OF ELECTRIC AIR DRILL

The drill is not at all an electric drill, according to the idea which the term usually conveys, but has an air-operated piston, and, so far as the striking of the blow is concerned, it is as completely air operated as any drill ever built. There is a drill cylinder sliding in a shell with a feed screw, the shell mounted upon a tripod, bar or column in the usual way. There are, however, no valves or valve-operating devices, no buffers or yielding connections for the heads. Provision is made for rotating the drill piston and that is all the mechanism about the drill proper.

Practically as near the drill as possible is a little truck upon which is mounted a small electric motor which is geared to a shaft carrying two cranks that alternately operate the two single-acting trunk pistons of two vertical air-compressor cylinders. A short length of hose connects one of these cylinders with one end of the drill cylinder, and the other end of the drill cylinder is connected by another hose to the other air cylinder. There are thus two distinct bodies of air which play back and forth without in any way communicating with each other, and by the alternating pulsations of these two bodies of air the piston is thrown back and forth. The normal pressure of these bodies of air being about 30 lb. gage, the pressure is alternately much greater and then much less than this for each rotation of the crank shaft and each corresponding stroke of the drill.

This arrangement, instead of being a complication, is in fact a great simplification of the usual air-operating arrangements. All of the parts of the drill which usually give trouble and cost so much for repairs or renewals are eliminated, and the compressors, which in this case may more properly be called pulsators, have no valves and no water jackets. There is no heating up in operation, as the heating and the cooling effects of compression and re-expansion balance each other. The apparatus thus briefly described comprises everything beyond the generator and wiring. Figs. 1 and 2 give a sufficient idea of the drill without further explanation.

It has happened to more than one of the great mechanical inventions which have made their mark upon our industrial progress, and have found permanent and growing employment, that the original inventors of them were far from realizing some of their most important and valuable properties and possibilities. I wonder how completely the inventor of the electric air drill knew his invention just before the first trial of it. The completeness of the invention in detail at the very beginning would indicate that the inventor knew with equal completeness what he was about. And yet was it not more or less a surprise to him, and of course a very welcome one, that the drill would strike so hard a blow? If he was not so surprised many others have been, and many more will be. As an experienced runner and tester told me, "She strikes the wickedest blow yet." It strikes such a blow that they tell me it is generally advisable to dress the bits a little blunter than usual, so that they will be less apt to break.

After the fact of the "wicked" blow is realized it is not really hard to find the explanation of it, although few would have studied it out in advance. In the standard air-driven drill, the piston when working is running away from the air that is driving it. The working air pressure in the pipes is practically constant, or changes very slowly, and the throttle and the ports will let the air in only at a certain velocity at the best, so that while the speed of the piston is increasing the pressure behind it will not fully keep up with it, and the piston, in each separate stroke, is thus driven by a constantly diminishing pressure in the cylinder from the start. At the same time the air on the other side of the piston, which has to get out of the way, has only a restricted passage and a constant pressure, that of the atmosphere, beyond it, so that with an accelerating piston movement the pressure or resistance in front of it must necessarily increase as the piston advances and goes faster.

I am not saying here how much the piston-driving pressure will thus decrease during the working stroke or how much the opposing, or exhaust, pressure will have increased at the precise moment when the rock is struck, but the fact of such simultaneous decrease and increase of pressure seems to be indisputable. Now, in the electric air drill the compressor piston is pushing the drill piston, the body of air in the hose and in the

connected ends of the cylinders communicating or delivering the push. The drill piston starts with a big pressure behind it, due to the compression of the air in the cushioning of the return stroke, and then the compressor piston, being crank driven, follows up this pressure with a rapidly accelerated advance, so that the drill piston up to and somewhat beyond the middle of the stroke of the compressor piston is followed and driven not by a decreasing, but by an increasing pressure, and this pressure when at its highest is practically maintained upon the drill piston until the rock is struck. In operating the drill it is evident that the precise point of the drill-piston stroke at which the rock is struck is a matter of considerable importance, and we can assume that more judgment may be required in feeding the electric air drill than the standard air drill, but this judgment will soon develop in the runner, and the drill itself will show a disposition to insist upon its rights as to its proper feed.

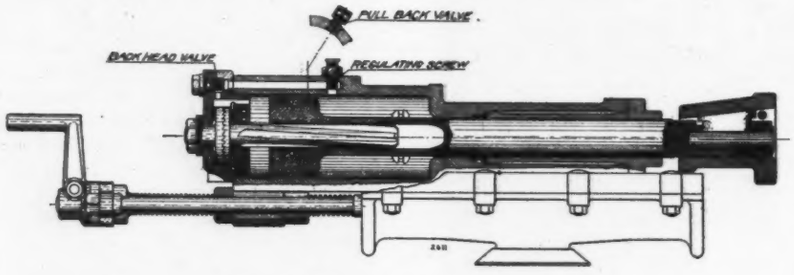

FIG. 2. SECTION OF ELECTRIC AIR DRILL

This crank acceleration of the compressor piston, thus causing an increasing pressure behind the drill piston, necessarily implies also a diminishing pressure in front of the piston, both conditions co-operating to produce a more rapid acceleration of the movement of the drill piston and a consequently higher velocity when the rock is struck, thus accounting for the "wickedness" of the blow. It is to be remembered that the pressures in this apparatus are at no time absolutely high, as the cylinder diameters are large, so that the differences of pressures which occur, and the preponderances of the differences either way count for more than in the old-style drill.

Another decidedly valuable property of this drill may have been thought of by the inventor in the beginning, and later, perhaps, also by others when they have come to study the working of it; but a great many will not have thought it out in advance; and that is the habit which the electric air drill has of yanking itself free when the bit sticks in the hole, and going right on with its work again. If I were a drill runner—which I never was and never will be—the most trying thing to me would be the sticking of the bit in the hole. With the old style of drill, when the bit sticks and the dead pressure of the air is not enough to pull it free at once, that ends it as far as the drill is concerned, and time begins to be lost on the job from that moment. The steel has to be hammered, and the feed has to be run up or down, and a lot of coaxing has to be gone through with before the drill settles down to business again.

The electric air drill never gives up like that. If it is running along at the rate of 300 or 400 blows a minute and the bit sticks, the motor and the compressor take no notice of the interruption, but keep going right along at the same speed as before. This means 300 or 400 jerks a minute on the steel in both directions, and it would be impossible for anybody to think of anything more effective for freeing the bit than just that. Generally, before a wrench can be grabbed to hit the steel the drill is running all right again. The drill thus saves a lot of time for itself by not wasting it as the other does. Where there is no actual dead stop of the drill in the hole, but just dragging or sluggish action on account of choking or "muddling," the pull of the electric air drill gets along with the trouble better than the old drill, because the pull is stronger.

The above is, of course, more or less speculative in character, and must not be taken as coming from one who knows everything for certain. It shows my willingness to try to provoke others to think up and to talk about the working of this very novel and highly interesting drill. If my explanation of things is not more or less correct, as far as it goes, will not someone help to set me right upon it? There are certainly many things to find accurate statements of and adequate accountings for in connection with the practical working of the electric air drill.

FRANK RICHARDS.

New York, Sept. 29, 1906.

Tapping Water in Mines

We have at one of our new mines in New Jersey a problem concerning which we should like your suggestion. It is to unwater the old workings of a mine about 500 ft. deep, from the bottom of a new shaft approximately 150 ft. distant from the end of the original workings. We plan to install a pump at the foot of the new shaft and bore a diamond-drill hole through the intervening rock, taking care of the water as it comes through into the new mine. The best method of controlling this supply at the start is the question about which we are uncertain. We shall appreciate any information or suggestions which you may make.

H. B. C.

Oxford, N. J., Oct. 1, 1906.

[A problem of this kind has been successfully solved in the following manner: When the drill hole is near the old workings in which the water is standing, it being assumed that the location is precisely known, enlarge the hole at the face where boring was commenced, and set in with cement a wrought-iron pipe of sufficient diameter to permit the easy passage of the drill rods. If necessary, this pipe can be braced in place by struts bearing against hitches in the walls of the drift. The large pipe should project out from the face of the drift, and should be provided with a suitable gate valve, and in front of the latter should be reduced by suitable fittings to a diameter to make a stuffing-box for the drill rods to work through. The water having been tapped, the drill rods can be slowly withdrawn beyond the gate valve, which then can be closed, after which the drill, etc., can be removed, and the water can be drawn off as desired. It would be of general interest if our readers who have handled similar problems would contribute their experiences.—EDITOR.]

Use of Wood in Copper Smelting

It may interest the readers of the JOURNAL to know of the progress in smelting copper-sulphide ores direct with the use of wood, charcoal, and coke, at the Mitchell Mining Company's mines in Guerrero, Mexico.

At the present time, pending construction of our railroad, we are operating a 200-ton smelting plant, and on account of the high cost of coke we have endeavored to dispense almost entirely with the use of coke, which we have very nearly accomplished. In various experiments with one-third oak blocks, one-third charcoal, and one-third coke we have not been very successful. Using two-thirds wood and one-third coke, we found with this large amount of wood on the charge that we did not get the desired degree of concentration. For instance, in smelting the ore with a full coke charge we make a matte of about 40 per cent.; with two-thirds wood and one-third coke we make a matte of about 28 to 30 per cent. from the same class of ore. We found that wooden blocks, which we have cut in dimensions of 3 in., ignite very readily, using up all the oxygen, and burn out before getting to the fusion zone, making a hot top on the furnace. This robbed us of the oxygen necessary for desulphuriza-

tion that we would otherwise get by the use of a large amount of fixed carbon in fuel used in the charge. However, we eliminated considerable of this difficulty by dipping the wooden blocks in a thin paste of silica and clay.

The proportions of this paste, or wash, are such that there is enough clay as a binder to adhere to the block so that it will not crack and fall off readily. The mixture should be just thick enough so that the blocks can be readily dipped in it, leaving a thin coating of the paste on the block. This same thing can be done with a mixture of lime, clay and silica. I should advise in case of charges where the ore is silicious that as little silica as possible be employed for the treatment of the blocks, using more lime and clay, and *vice versa* with a basic charge.

It was found that blocks treated in this way did not catch fire on the top of the charge as soon as the untreated blocks, and passed down nearly to the fusion zone, thus giving us carbon enough for smelting purposes in the fusion zone. The results have been excellent, and we are smelting with wood entirely as fuel. We have obtained a much higher concentration, making a matte of 38 per cent. as against a matte of about 20 to 25 per cent. with blocks used without dipping in this clay. This ability to use wooden blocks for smelting, and no coke, is a great saving for us. The wooden blocks are far superior to the use of charcoal for sulphide smelting, so far as our experiment has gone, and we are continuing to smelt with wooden blocks, pending completion of our railroad. By this method we are able to keep our smelting and converting plant running and at a very low cost of production.

We do not get the full smelting capacity from the furnace that we would with the full coke charge, and, of course, it goes without saying that the full coke charge is the best, but under our present conditions it can readily be seen what can be done with a mine that is near a big forest and has plenty of timber, when cost of coke is so high.

GEORGE MITCHELL.
President, Mitchell Mining Company.
New York, Sept. 27, 1906.

The DeBavay plant, which has been put in operation at Broken Hill, consists of four units, each of seven concentrating tables. The tailings, after being crushed fine, are fed to an agitator and treated with carbonic acid gas. After being passed through a second agitator and thoroughly washed, the material is passed over a series of tables, the surfaces of which are inclined at an angle of 45 deg. At the lower edge of each table runs a narrow trough of water, and directly the zinc strikes this it floats on the surface and overflows into a receptacle leading to a receiving vat below. The gangue sinks and is re-treated over the tables beneath.

Patents Relating to Mining and Metallurgy

UNITED STATES

The following is a list of patents relating to mining and metallurgy and kindred subjects, issued by the United States Patent Office. A copy of the specifications of any of these will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. In ordering specifications, correspondents are requested to name the issue of the JOURNAL in which notice of the patent appeared.

Published Week Ended Sept. 25, 1906.

LAUNDER—Raymond L. Dimmick, Denver, Colorado. No. 831,545. Filed June 14, 1905.

ORE FEEDER—Forrest H. Blanding, San Francisco, Cal., assignor to Union Iron Works Company, San Francisco, Cal. No. 831,595. Filed May 15, 1905.

ORE-SIZING SCREEN—Clarence E. Ratcliff and Jacob A. Cohenour, Salem, Ky. No. 831,681. Filed Feb. 9, 1906.

PROCESS FOR THE ELECTROLYTIC PRODUCTION OF ZINC—Victor Engelhardt, Vienna, Austria-Hungary, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. No. 831,843. Filed Sept. 14, 1904.

FEED-WATER HEATER AND PURIFIER—Henry E. Moffat, Woodstock, Ontario, Canada. No. 831,886. Filed Oct. 30, 1905.

ROTARY PUMP—Harry R. Comly, San Diego, Cal. No. 831,933. Filed March 8, 1905.

DEVICE FOR CHARGING AND DRAWING INGOTS AND THE LIKE—Wm. T. Martersteck, Sharon, Pa. No. 831,964. Filed Jan. 6, 1906.

DUMPING AND ELEVATING APPARATUS. Philip J. Mauger, Minier, Ill. No. 831,966. Filed March 15, 1906.

VALVE FOR BLOWING ENGINES—Johann F. M. Patitz, Milwaukee, Wis., assignor to Allis-Chalmers Company, Milwaukee, Wis. No. 831,982. Filed Dec. 15, 1902. Renewed April 25, 1906.

SEPARATOR—Joseph F. Custard, Bath, Pa. No. 832,012. Filed April 7, 1905.

PROCESS FOR THE ELECTRO-DEPOSITION OF METALS—Josef A. Nussbaum, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. No. 832,024. Filed Nov. 28, 1905.

Published Week Ended Oct. 2, 1906.

AUTOMATIC WEIGHING AND MIXING APPARATUS—Thomas A. Edison, Llewellyn Park, N. J. No. 832,046. Filed Jan. 9, 1903.

ORE SLIMER — William F. Smith, Whitecross, Colo. No. 832,091. Filed April 4, 1905.

COAL-DRILL ATTACHMENT—James T. Tabor, Athens, Ill. No. 832,096. Filed Jan. 22, 1906.

TUNNEL AND MEANS FOR CONSTRUCTING THE SAME—Jules Breuchaud, Yonkers, N. Y. No. 832,120. Original application filed Feb. 24, 1902. Divided and this application filed May 29, 1902.

PROCESS OF TREATING SLIMES—Harry N. Thomson and Frederick Laist, Anaconda, Mont. No. 832,176. Filed March 19, 1906.

MACHINE FOR FORMING CLAY CONDENSERS—Lewis E. Vanatta, Iola, Kan. No. 832,177. Filed March 31, 1906.

CENTRIFUGAL PUMP—William I. Bettis, Houston, Tex., assignor of one-half to Hugh Hamilton, Houston, Tex. No. 832,230. Filed Jan. 18, 1905.

ORE-ROASTING FURNACE—Thos. Edwards, Ballarat, Victoria. No. 832,248. Filed Dec. 19, 1903.

COMBINED AGITATING AND LEACHING TANK—Ernest L. Godbe, Salt Lake City, Utah. No. 832,252. Filed Dec. 5, 1905.

ORE ROASTING AND OXIDIZING APPARATUS—Fessenden C. Butterfield, Oakland, Cal. No. 832,292. Filed Aug. 24, 1905.

PROCESS OF TREATING COMPLEX SULPHIDE ORES—William G. Rumbold and George Patchin, London, England. No. 832,341. Filed Feb. 3, 1906.

DISINTEGRATOR FOR SUCTION DREDGERS—Henricus P. A. J. Smulders, Rotterdam, Netherlands. No. 832,345. Filed Oct. 10, 1905.

CHECK HOLDER FOR DUMP CARS—Geo. L. Summers, Huntington, W. Va. No. 832,347. Filed April 19, 1906.

FURNACE FOR CALCINING OR BURNING BRIQUETS OF ORE—Filip J. Bergendal, Herrang Hafverosund, Sweden. No. 832,358. Filed April 8, 1905.

TUNNEL MINER'S POWER SHOVEL—Patrick Ford, Chicago, Ill. No. 832,370. Filed Dec. 26, 1905.

INTERLOCKING METAL SHEET PILING—George E. Nye, Chicago, Ill., assignor of one-half to Gustavus A. Kreis, Chicago, Ill. No. 832,407. Filed June 26, 1906.

MANUFACTURE OF FLAKE MICA FROM MICA PLATES, CRYSTALS OR NODULES—Henry C. Michell, London, England. No. 832,494. Filed Oct. 8, 1901.

BRIQUETING MACHINE—Howard E. Marsh, Los Angeles, Cal., assignor of one-half to William P. Wagy and one-fourth to F. D. Parker, Los Angeles, Cal. No. 832,553. Filed Jan. 30, 1905.

PROCESS OF SEPARATING METALS FROM THEIR ORES—George H. Waterbury, Denver, Colo., assignor of one-third to John J. Huddart, Denver, Colo. No. 832,563. Filed March 27, 1905.

GREAT BRITAIN.

The following is a list of patents published by the British Patent Office on subjects connected with mining and metallurgy.

Published Week Ended Sept. 22, 1906.

SAFETY LAMP—J. G. Patterson, Darlington. An arrangement for reflectors for safety lamps so that the roof may be inspected without tilting the lamp. 17,916 of 1905.

VENTILATING FAN—W. Clifford, Jeannette, Pennsylvania, U. S. A. Improvements in ventilating fans for mines, with the object of reducing internal resistance to the air through the fan. 26,988 of 1905.

METALLURGICAL PROCESS—R. Conedera, Massa Marittima, Italy. A method of roasting copper pyrites in such a way that copper sulphate may afterward be obtained by lixiviation and no iron dissolved in the operation. 1299 of 1906.

CAST-IRON MIXTURE—E. and S. Wallis, Derby. An improved cast-iron, tougher and of closer grain, made by mixing pig, scrap cast iron and a small proportion of mild steel. 9453 of 1906.

KEYLESS TAPPETS—A. G. F. Craufurd, Johannesburg, S. A. An improved means of securing keyless tappets on stamp stems, so as to enable the position of the tappet to be adjusted upon the stem in an improved manner. 10,502 of 1906.

ROTARY SCREEN—C. A. Pool, Hayle, Cornwall. An improved form of rotary screen, with several concentric screens. 12,814 of 1906.

Published Week Ended Sept. 29, 1906.

CRYSTALLIZING TANK—G. Schicht, Vienna, Austria. Arrangement of cooling tanks for hastening the crystallization of soda and other similar salts. 10,917 of 1905.

SMELTING FURNACE—R. W. E. MacIvor and M. Fradd, London. A rotary furnace for smelting tin ore by the action of producer gas. 10,943 of 1905.

ELECTROLYTE—H. M. Chance, Philadelphia, Pa., U. S. A. An electrolytic bath for removing impurities from iron, copper or other metal, the electrolyte consisting of fused halojen salt of alkali or alkaline earth metal, the current setting free the metal, which immediately combines with the impurities in the metal to be refined. 17,449 of 1905.

ROASTING PROCESS—W. Blackmore and A. Howard, London. Roasting pyritic ores at a temperature of 800 deg. F. in the presence of air and steam, so as to produce sulphates of the metals, removing the sulphates by lixiviation, and subsequently treating the residues for precious metal contents. 17,839 of 1905.

STAMP MILL—G. R. Bonnard, G. W. Beynon and G. H. Mackillop, London. In stamp mills, using an additional set of cams which help the stamps downward in addition to the action of gravity. 19,725 of 1905.

SAFETY LAMP—W. Best, Morley. An improved safety lamp with two concentric glass cylinders, which can be cleaned with as great ease as the single-cylinder lamp. 26,561 of 1905.

ALUMINUM SOLDER — M Gruber, Berlin, Germany. A solder for aluminum, consisting of 10 parts copper, 25 parts zinc, 60 parts tin, 3 parts cadmium and 2 parts aluminum. 12,599 of 1905.

ROCK DRILL—Ingersoll-Rand Co., New York, U. S. A. In rock drills, means for bringing the closed tailrod chamber into open communication with one of the fluid-pressure pipes or the atmosphere for controlling the operation of the drill. 13,016 of 1905.

Personal.

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURAL informed of their movements and appointments.

E. W. Sebben, of Denver, Colo., is in New Mexico, making important examinations.

Robert Millar, general manager of the Caledonian Railway, Scotland, is in Toronto.

E. P. Earle, of New York, president of the Nipissing Mines Company, has been in Cobalt.

L. C. Buhler, of the Carnegie Steel Company, is in Denver, Colo., on business.

Frank Lawrance, of Idaho Springs, Colo., is visiting Denver and Boulder on professional business.

F. H. Clergue, general manager of the Lake Superior Corporation, was in Vancouver, B. C., recently.

W. H. Holmes has returned to Denver from Silver City, where he has been to report on mining properties.

Henry Harris, superintendent of the Hall Mine smelter at Nelson, British Columbia, was in Denver, Colo., recently.

Joseph R. De Lamar was in Cobalt camp for some days recently in connection with the development of the Nipissing mines.

C. Lightburn and W. O. McFarland, of Denver, have been in Breckenridge, Colo., looking after their respective interests in Summit Gulch.

Foster Hewett, of Pittsburg, Penn., is in England on professional business. His present address is the New Savoy Hotel, London, England.

J. C. Maben, president of the Sloss-Sheffield Steel and Iron Company, has gone on a European trip. He will be gone about two months.

J. Parke Channing, of New York, returned last week from an extended trip in the West, where he has been engaged on professional business.

Erich Koischwitz, for the last two years chemist and consulting mining engineer with Otto Reimers & Co., Yokohama, Japan, has gone to Europe.

Arthur H. Rudd, of Golden, Colo., has accepted a position as surveyor with H. E. Merryman, United States deputy mineral surveyor, at Enterprise, Oregon.

Morris Bush, general manager of furnaces with the Alabama Consolidated Coal and Iron Company, has gone on a trip to Europe. He will be absent several weeks.

E. M. Tutweiler, formerly at the head of the Tutweiler Coal and Iron Company, and now interested in iron and coal properties in Alabama, has just returned from a European trip.

Gentry Hillman has been appointed general furnace manager of the Southern Steel Company with headquarters in Birmingham. Mr. Hillman has had much experience with Southern furnaces.

Sigmund Rothschild, president of the Canadian Klondike Mining Company, is in New York securing an extensive electrical equipment to be installed on the Yukon river.

R. L. Lloyd, who recently resigned his position as metallurgist for the Greene Consolidated Copper Company, at Cananea, Sonora, has gone to Chile as metallurgist for the Braden Copper Company.

Chas. J. Bandmann and W. J. Adams, consulting mining engineers, are now permanently located in the Monadnock building, San Francisco. This is the first mining engineering office to return to the burnt district.

Frank E. Wire, of Libertyville, Ill., president of the Square Deal Mining and Development Company, has been appointed by the governor of Illinois official representative to the American Mining Congress, in Denver.

James E. Chapman, who for the past three years has been engineer for the South American Development Company, at Zaruma, Ecuador, has gone to northern Michigan, where he has taken a similar engagement with the Atlantic Mining Company.

Alexander Veitch, formerly general manager of the Arizona Copper Company, who has just returned from a two months' trip abroad, has been appointed consulting engineer of the New England & Clifton Copper Company, which is controlled by Boston people.

Thomas W. Parry, of Avoca, Penn., was tendered a reception at his home by a large party of miners last week upon the occasion of his appointment as superintendent of the Mayfield district of the Erie collieries. Until recently he was superintendent of the Butler colliery of the same company.

Dr. E. D. Peters, of Dorchester, Mass., has been devoting a large part of his time during the last summer to the completion of his treatise, which is to be called "Principles of Copper Smelting." It will be published by the ENGINEERING AND MINING JOURNAL. It is expected that the book will be out about Feb. 1, 1907.

Obituary

Adam E. Hitchens died at Frostburg, Md., Oct. 5, aged 74 years. He was born in England in 1832, and came to this country when a young man. He settled in Frostburg, and after some years organized the Hitchens Brothers Company, which came later to conduct a large commercial business. Gradually Mr. Hitchens acquired large interests in the George's Creek coalfield. He was interested in several mines, and for a number of years and up to the time of his death, was manager of the Barton & Georges Creek Coal Company.

Societies and Technical Schools

University of Pennsylvania—The new building for the engineering department at Thirty-third and Locust streets, Philadelphia, will be formally dedicated on Friday, Oct. 19, with appropriate ceremonies.

Western Association of Technical Chemists and Metallurgists—The Colorado Section sends us the following invitation, which is neatly and appropriately printed on a circular piece of filter paper, ready for use:

"The Colorado Section of the Western Association of Technical Chemists and Metallurgists hereby summons you to appear at The Savoy, Denver, Colorado, Saturday evening, Ocober 13, 1906, for the purpose of joining with various other confederates of this clan in an attempt to dispose of certain highly carbonaceous and nitrogenous compounds, also hydrocarbons of high and low specific gravity, not to mention liquids of varying degrees of caloric intensity. . . . The obsequies will get under way at 7:30 p.m. and will continue as long as anything of a digestible nature remains in sight—assuming, of course, that the responses to the various toasts have not put all the guests in an unconscious condition. . . .The minimum readiness-to-serve charges of $1.50 per casserole will be collected; all destruction of apparatus, whether by accident or intent, will be charged extra. R_2 S_4 $(V\ P)_{10}$."

Industrial

The Stevens-Adamson Manufacturing Company has opened an office in the Wall Street Exchange building, in New York, under charge of Frank H. McWethey.

The Rust Boiler Company, of Pittsburg, Penn., has secured the order for the boilers for the United States Steel Corporation's new plant at Gary, Ind., the order being for sixteen 400-h.p. Rust water-tube boilers.

The Colorado Iron Works Company, of Denver, has received an order for equipment for a 10-stamp mill, with concentrating machinery, from the Tonopah-Liberty Mining Company, to be erected this fall near Tonopah, Nevada.

A branch establishment will be erected in Montreal by the Philip Carey Manufacturing Company, of Cincinnati, Ohio, manufacturers of asbestos goods, the object being to save the duty of 25 per cent. on raw asbestos on goods supplied to the Canadian market.

Charles C. Moore & Co., Inc., inform us that they are now at their old address, No. 63 First street, San Francisco. They

have succeeded in erecting a temporary building suitable for the prosecution of their business, and are ready to undertake engineering work, as heretofore.

At Newell, W. Va., a new town on the Ohio river, opposite East Liverpool, O., the North American Manufacturing Company is constructing a new plant. The H. W. Johns-Manville Company has secured the contract for covering the buildings of nearly the entire plant with its "J-M" asbestos roofings. The award was made after thorough tests.

The Bristol Company, Waterbury, Conn., announces that it has established a branch office at 753 Monadnock building, Chicago. Its representatives there can offer helpful suggestions regarding the operation of Bristol recorders, besides full information about new types and changes. This Chicago branch will often be able to fill rush orders, particularly for instrument supplies—thus saving time delivery.

A decision has just been reached by the United States Steel Corporation to build three or four new blast furnaces in the Pittsburg district. The additions will be chiefly at the Duquesne plant, though it is probable that one furnace will be built at Donora. The open-hearth steel capacity will be increased at the same time by the building of 30 new 50-ton furnaces. These latter additions will be made chiefly at Pittsburg district plants, but it is probable that some of the new open-hearth capacity will be in the Cleveland district at the works of the American Steel and Wire Company.

The Standard Roller Bearing Company has purchased the plant and real estate of the Pennsylvania Iron Works Company which adjoin its present property. The price paid was nearly $250,000 and it will immediately be equipped with machinery. The Standard Roller Bearing Company is at present erecting the largest reinforced concrete building in Philadelphia or vicinity, five stories in hight, 100x210 ft. This building will be devoted exclusively to the manufacture of annular ball bearings. The company has built and equipped a large crucible-steel casting plant, as well as an iron and brass foundry. It has also completed a drop-forging plant, 100x150 ft., fully equipped with Billings & Spencer drop hammers.

A few months ago, the Thomas Furnace Company, of Milwaukee, purchased from the Allis-Chalmers Company a long crosshead blowing engine of the standard type. This engine has been installed to operate under somewhat unusual conditions. The plant originally consisted of two 42 and 84x54-in. long crosshead blowing engines fitted with piston valves and throttling governor. The engines were uneconomical in their operation, so much so that a large quantity of coal was burned in addition to the gases taken from the furnace to make the steam required to operate them. The new engine receives its steam from the exhaust of one of the old ones, the other being shut down. The exhaust steam from the new engine is condensed with a Tomlinson barometric condenser provided with double tail pipes and a novel form of air-injector nozzle which effectually removes the air from the condenser without the use of a dry-air pump. The water is supplied to the condenser by a 10-in. centrifugal pump driven by small vertical engine. This pump and engine are the only parts of the condensing system that require any attention. The water for the condenser is foul, and its temperature is about 82 deg. With this warm injection water, they are able to easily maintain 26 in. vacuum.

Trade Catalogs

Receipt is acknowledged of the following catalogs and circulars:

Coöperative Electrical Development Association of Cleveland. Applications of Electricity; Pp. 32, paper, 3x8 in. 1906.

Vulcan Bearing Bar Company, Wilkes-Barre, Penn. Patent Drop Door Bearing Bar; Pp. 6, illustrated; paper, 3x5 in. 1906.

R. B. Sigafoos, Helena, Mont. Preliminary Prospectus of the American Rotary Shaft and Tunnel Machine Company; Pp. 32, illustrated; paper, 8x10 in. 1906.

Stephens-Adamson Manufacturing Company, Aurora, Ill. *Conveying and Transmission,* June, July, August and September, 1906; Pp. 16-24, illustrated; paper, 6x4 in.

Construction News

Deadwood, South Dakota—The Anaconda Mining Company is considering the erection of a small stamp-mill. F. H. Herhold, Chicago, is president.

Cobalt, Ontario—The Foster-Cobalt Mining Company proposes to put in an air compressor, power plant and hoist. F. G. Loring, Cobalt, Ont., is engineer in charge of operations.

Moxtepec District, Guerrero, Mexico—The San Mateo Mining Company is preparing to put in a concentrating plant at its mine. It is at Poder de Dios, and Robert Wilson is manager.

Montreal, Canada—The Morgan cement works, near Montreal, have been bought by a syndicate of Canadian and New York people, and will be enlarged. New machinery will be needed. W. R. Warren, New York, is interested.

Republic, Washington—Plans are under discussion for a large plant to treat the ores of several of the mines in the Republic district. The owners of the mines have been in consultation about the matter. W. B. Potter, St. Louis, Mo., is consulting engineer.

Special Correspondence

San Francisco Oct. 3

A so called "diamond mine" is being opened on the Cherokee road about a mile from Oroville, Butte county, by M. J. Cooney, who claims to have had experience in diamond mining in South Africa. In years past a number of small diamonds have been found in this locality, but until now, no one has considered it worth while to make a systematic search for them. The largest one ever found there is owned by Louis A. Glass, of San Francisco, formerly a mine manager at Cherokee. He considers the diamond worth about $75, and does not know of any more valuable having been found in the locality. Just as this ground is being opened, comes news of supposed diamond discoveries at Dehesa and at Mesa Grande in San Diego county. However, in all these cases the existence of valuable diamonds has yet to be proven.

The bonding of the True Friend group of claims by the Masonic Mountain Gold Mining Company is a good thing for Masonic district, Mono county. The property has been tied up for a year or more though known to be valuable. The company, instead of re-commencing work on its Lost Horse group, will now give its attention to the True Friend. The croppings are very bold and assay good values. The men in the new company have plenty of funds to carry on extensive development work which will inure to the present benefit of the district.

The Union Copper Mining Company, of Copperopolis, Calaveras county, has completed surveys for a 12-mile branch railroad to connect its mines with the main line of the Southern Pacific Company at Milton. This is one of the oldest copper properties in California and now that its smelting works are completed will doubtless soon rank among the producers.

The recent strike of high-grade ore in the Mountain Meadows mine, Mountain Meadows district, Plumas county, is encouraging to the miners and prospectors in the Plumas copper belt. This cuts through the east central portion of Plumas county from southeast to northwest, being traced for a distance of 60 miles, and averages 10 miles wide. A boom was started last spring in this belt, and a number of enterprises were started to develop different properties on a large scale, San Francisco capitalists backing them up. The April disaster nipped the boom, and the promoters of the enterprises had to go East for funds to carry out their plans. The negotiations are now commencing to bear fruit, Eastern capital coming in. Prominent Western mining men have also sent representatives to get the lay of the land, Walker Brothers and McCornick, of Salt Lake, being among the operators who have secured options on properties in the Plumas copper belt. Wealthy Germans in St. Louis and Chicago have signi-

fied their intention through their agents in San Francisco, to provide the money whereby the Lights Cañon copper mines are to be more systematically exploited. These include the Hulsman and Engle mines. The latter have been under development for the past 30 years and have finally been put into the market. Vienna (Austria) capitalists have bonded several parcels of land in Indian Valley, on one of which it is intended to erect a smelter for the adjacent mines.

The demand for electric power by the large mines of Siskiyou county is taxing the plants of the Siskiyou Electric Light and Power Company to their full capacity. The Ashland (Oregon) plant has been rebuilt and enlarged. The Fall Creek plant will have larger wheels and generators, so as to furnish 25,000 h.p. The demand for power is becoming so great that the company has also decided to combine the Shasta River power-plant with the Fall Creek plant.

The American Railway Company of California has been organized and the proposed line will open up some of the coal-fields of Amador county. Among other things which the company asks is the right to acquire the line of the Ione & Eastern Railroad Company, a road extending from Ione to Martels, about 20 miles, which was recently constructed. It is proposed to extend this from Martels northeast to Bartons, making the total length about 33 miles.

It is understood that Wm. Davidson has instructions from the California Copper Company to reopen the copper mines at Daulton, Madera county, and overhaul and put the smelter in conditions for use. It is understood that a shaft 500 ft. deep will be sunk and crosscutting done to develop the property.

A new corporation, the New Coso Mining Company, has bonded the Lucky Jim mine near Darwin, Inyo county, on the Defiance-Independence ore belt. The Lucky Jim, with its sister mine, the Christmas Gift, is one of the old time properties of that part of the country. A great deal of work was done there, by the original New Coso Company, and by J. A. McKenzie, its successor in proprietorship. The largest two-stack smelter in the country was built at Darwin for reducing ores from the two mines. A new shaft is to be sunk and a smelter provided. The ore is a silver-lead carrying some gold. That whole silver-lead section of Inyo county virtually idle for some 25 years will probably be again the scene of active operations shortly.

Preparations are being made to reopen some of the large quartz mines of Ophir district, near Auburn, Placer county. These included the Eclipse, Gold Blossom, Bellevue, Three Stars, and Hathaway. Some of these have not been in operation for some years. The water has been pumped out of the Eclipse, and its machinery is being renewed and put in order. A new electric plant is being put in the Hathaway.

E. D. Kitts and Albert Rigby have begun suit in the Superior Court of Nevada City against the New Blue Point Mining Company. A receiver is asked for with power to raise money to be used in placing the ditches and flumes of the company in condition to enable it to resume mining.

Bisbee, Arizona Oct. 6

The scarcity of men for both mining and smelting operations in this region continues and the expected increase of the year will hardly be made. Though there will be a large increase over any previous year, the early estimates of 150,000,000 lb. for Bisbee, for example, will not be reached. The monthly production of that district is now 12,000,000 lb., but for September it will be increased to nearly 14,000,000 lb, by the addition of a furnace at the Copper Queen reduction works and the advent of the Shattuck as a producer for its first full month. The Calumet & Arizona reduction works have not yet blown in the fourth furnace, which has been ready for operation for a month, and which should increase the monthly product by 1,300,000 lb. The management states that this is because it cannot get men. With the coming of cool weather further north, it is probable that more miners and smeltermen will drift to southern Arizona.

Copper Queen has completed and blown in its No. 9 furnace, which is 44x240 in., and is at work on No. 10, which should be ready about the close of the year. The company is constantly increasing its custom work, and has now a large business in that line, rejecting all ores that carry lead. Its September production should amount to about 8,800,000 lb. of blister copper.

At the Superior & Pittsburg mines development underground is showing important ore reserves and a large amount of leached material, which leads to the confident expectation of larger orebodies below. The Briggs shaft is now 1220 ft. deep, and sinking will soon cease while a station is cut for drifting on a new bottom level. The Junction shaft is 1130 ft. deep, and here, too, drifting begins shortly. The Cole shaft is now about 1300 ft. deep. This company is making in the neighborhood of 1,000,000 lb. a month.

It is reported from Pinal county that the Calumet & Arizona is entering that field, but the probability is that the rumor arises from the fact that some engineers connected with it have been looking over claims there. It is scarcely credible that this company itself has taken an active interest there.

Lake Superior & Arizona is looking very well, and a meeting will soon be held at Calumet for the purpose of arranging the financial details for the construction of a railway to Florence, 28 miles, and a 250-ton matte smelter, the cost of which improvements will be $500,000, or more.

Ore has been cut in the bottom of the Cloe shaft at Bisbee, belonging to the Superior & Pittsburg.

A considerable party of geologists returning from the International Congress of Geologists at Mexico City, has been at Douglas, Cananea and Bisbee the past few days.

Salt Lake City Oct. 6

Utah smelting companies are greatly perturbed over the possibilty of a coal famine and it has been only with extreme difficulty that the Salt Lake valley plants have been kept running at full blast all this week. The Consolidated Mercur ran short and had to shut down for a day or two. Railroads are short of equipment and are physically unable to handle traffic with despatch. To make matters worse, equipment has been diverted to the sugar-beet fields during the harvest now in progress.

Rumors are persistent that the deal pending some time ago to bring the Boston Consolidated and Utah Copper mines in Bingham into a consolidation, and to operate under one management, is being revived.

The directors of the Sacramento Gold Mining Company paid a dividend of $5000 on Oct. 1.

The new smelter of the Utah Smelting Company near Ogden is about ready for commission, but the start is being delayed on account of the incomplete condition of the electric-power transmission line.

The ore producers of the Tintic district have affected a permanent organization, which is known as the Tintic Mine Operators' Association. C. E. Allen is president; John Dern, first vice-president; Lafayette Holbrook, second vice-president; Jackson McChrystal, treasurer; H. S. Joseph, secretary.

The annual meeting of shareholders of the New Stockton Mining Company, operating at Stockton, resulted in the retention of the old board of directors. J. J. Trenam, Eagle block, Salt Lake City, will continue as manager.

Denver Oct. 6

The superintendent of the Denver Mint has received instructions from Director Roberts to double his capacity in coining subsidiary pieces. For the time beng, half-dollars and quarters will be turned out chiefly. During the past month over $318,000 worth was coined and $2,050,853 worth of gold and silver bullion was purchased. It is generally understood that a large number of small coins will be manufactured for the Mexican government, as the mint of Mexico cannot turn them out in sufficient quantities. The upward tendency of the price of silver is an interesting question and has given en-

couragement in some of the silver-producing districts; 250,000 ounces have just been purchased at 69.21c. delivered at Denver.

Dr. George A. Suffa, of Boston, has filed a suit in the United States circuit court asking for the appointment of a receiver for the Big Five Tunnel, Ore, Reduction and Transportation Company, in connection with certain acts of its officers. The action brought by Dr. Suffa in the district court during the latter part of last year has been dismissed at the request of his attorneys.

Commissioner Charles A. Prouty, of the Interstate Commerce Commission, has finished the hearing of the evidence bearing on the relations of the Rio Grande Western Railway and the Utah Fuel Company, besides inquiring into the charges that the Union Pacific Company will only permit the Union Pacific Land Company to engage in the coal business in Wyoming. He has returned to Washington.

The Colorado, Utah & Southwestern Railway Company has just been incorporated for the purpose of building a railroad from some point in Grand county to Salt Lake City.

On Oct. 3 all records of shipments of ore from the Cripple Creek district were broken when 119 broad-gage cars were hauled out over the Short Line to the Colorado City and Pueblo reduction plants, besides 32 cars sent out by the narrow-gage road to the Arkansas Valley smelter.

Scranton Oct. 8

Test borings which have been carried on in the Keiper colliery of Markle & Co., near Hazleton, have proved the long held belief that there is no coal under the Buck mountain vein to be mistaken. Underneath this vein has been found another, fully 10 ft. thick. It is believed that there is still another underlying vein and the borings are being pushed onward to decide the matter.

Two new veins of coal have been found by James G. Harvey, of Wilkes-Barre, at Black creek, near Hazleton, one being 11 ft. and the second 14 ft. in thickness. A slope is being sunk and a breaker will be built. A number of new veins are being found in the Hazleton region, and experts declare that there is sufficient coal in the ground to last for 200 years. All theories on the location and extent of the coal basin have been upset by recent discoveries of new beds of coal under veins that were supposed to be at the bottom of the basin. It is impossible to buy any land in that section, owing to the discovery of new veins, and those who hold land under which it is supposed that there is anthracite are building hopes of great wealth.

L. M. Evans, mine inspector of the first anthracite district, has been nominated by the Republicans and indorsed by the Democrats for another term, and will therefore be re-elected without opposition.

The Susquehanna Coal Company, last week, issued orders to foremen to employ all the men they can find who are competent to work mine breasts with heavy pitches. Since the suspension last April, many miners have left the region, and have not returned, causing a scarcity of labor, which has not been overcome. Foreign-speaking miners, generally, cannot work on heavy pitches, as the task requires more than ordinary intelligence, and is a dangerous one.

London Oct. 2

The South African mining market, having little else to do, is discussing the policy of amalgamating groups of companies and mines, now adopted by many of the leading houses. For instance, four of the deep-level properties situated on the dip of the Simmer & Jack are to be amalgamated into one company, while the Geduld and its subsidiaries will shortly be another example of the amalgamation policy. Sneering critics allege that these subsidiary flotations and subsequent amalgamations benefit nobody but the accountant, lawyer and company promoter. They ask why the directors alternately sound the praises of separate and conjoint working. There are not wanting many such critics at present. I would point out, however, that there is a perfectly logical reason for the pursuance of such a policy. A prosperous company finds that adjoining properties belonging to it are worth development. The directors are immediately confronted with two considerations. Money will have to be spent on the development of the adjoining property, and if the money comes out of revenue, dividends will have to be suspended for a time. The second consideration is even worse, for it may be that the property may turn out to be quite valueless, and the losses incurred may hopelessly cripple the prosperous present company. Everything therefore points to the flotation of a subsidiary company. When the adjoining property has been proved and placed on a permanent basis, as regards prospects, it often happens that conjoint working with the parent will cut down expenses. This is especially the case with mines on the Rand, where economy is chiefly a question of mechanical engineering. It is not to be wondered at, therefore, that now that the possibilities of the deep levels have been fairly accurately gaged, there should be a series of amalgamations of adjoining properties, with a view to economy in working. This explanation of the circumstances seems desirable at the present time, and will serve to correct many false impressions.

The JOURNAL has frequently referred to the Dunderland Iron Ore Company which, under the auspices of the leading iron masters of Great Britian, is developing the iron ores of Norway. As was announced toward the end of last year, the railway and the port have been constructed, the deposits opened up, and the crushing and magnetic-separating plant is in working order. At that time, the briquetting plant was not complete, so that operations were hung up. Another year has come round and the briquetting plant is still in the experimental stage. The directors say in their official report just published that "various delays have been occasioned in perfecting this portion of the plant, but we are glad to say that such difficulties as have been experienced are purely of a mechanical kind, and are being solved. Meantime a small output of briquets is being daily produced and we see no reason to doubt that this output will now be a continuous and increasing one." This statement of the outlook is not a particularly inspiriting one. The directors also announce that further capital is required and that the balance of the debenture stock, £200,000, will be offered for subscription at an early date. The capital of the company consists of £2,000,000 in shares and £500,000 in debentures, of which, until this new issue is made, £300,000 has been subscribed. The scheme has been a great experiment, as I have stated all along, and at the present time anxiety is felt in financial and technical circles as to the outcome. It would, no doubt, have been best to perfect the processes before embarking on such great expenditure at the mines, but in the face of the confidence shown by the iron masters in the plans, policy and prospects of the company, I feel that any criticism now would be out of place.

Sydney, N. S. W. Sept. 3

In New South Wales, the dredging for tin is proving a very remunerative industry in the Tingga district. On present indications it would seem that the whole of the stanniferous gravels, which were so successfully worked in the past, can be profitably re-treated by means of the centrifugal-pump dredge. If so, there are years of work ahead. At the present time there are 19 plants in operation, while there are some seven others either in course of construction, or on the point of completion. The output of stream tin by these plants during one week was 28 tons. To show the results which are being secured, it may be mentioned that the Melbourne Cope's Creek Company commenced operations July 20, and from that date to Aug. 24, won 15 tons 7½ cwt. of tin ore. This return enabled the company to pay a dividend of 6d. per share practically within a month of starting work.

The sale of the Great Cobar Mining Syndicate's properties in New South Wales for the sum of £800,000 has been completed, and J. D. Kendall, one of the directors, has just arrived from London to enter into possession. It is understood that operations are to be prosecuted with greater energy, and the output of 4000 tons of copper per annum increased to 13,000 tons.

General Mining News

ALASKA

Shushitna River—Prospectors in this district during the past summer claim to have found coal outcrops near the headwaters of the river. Samples of the coal brought down are of good quality. Some gold was also found on the Shushitna, and on Colorado, a tributary creek; but hardly enough to work at a profit until better transportation is available.

ARIZONA

COCHISE COUNTY

Shannon Copper—This company has been taking some lands in Cochise county, at Gleason, including the Copper Belle property, and will develop at once. Superintendent Sultan has been on the ground there some time.

GILA COUNTY

Globe Consolidated—This company, at Globe, is sinking at the rate of 25 ft. per week in its new three-compartment vertical shaft and is getting copper signs. At about 200 ft. the first drift will be run to intersect ore supposed to exist at that level, but the destination of the shaft is about the 1000-ft. level, where it is expected that the deep veins in diorite, which the Globe management thinks are the big things of the district, will be met. The operations of both Old Dominion and Arizona Commercial, especially of late, have been most encouraging for any new company possessing large and well located tracts in their vicinity.

PINAL COUNTY

Kelvin District—All through this district there is activity, but in a small way. None of the companies are large producers, though the Calumet Copper Company is shipping about 40 tons of high-grade ore per day. At the old Ray, lessees have been permitted to go in, and the plans of its English owners for a large development on their own account seem to be in abeyance for the present. If this company is unable to make up its mind for big development now, it is doubtful if it ever can, for the present is the time when these large low-grade deposits can most successfully be financed.

YAVAPAI COUNTY

The Black Hills district, around Jerome, is active, but in a small way; there are a great many more prospects active there than in the past. But the development of new mines around Jerome has never been especially successful, and very little additional copper is coming from the region. Indeed, the only producer of consequence outside the United Verde is now closed, and will remain so as long as it suits Senator Clark's policy to have it idle.

Black Mountain—This company is now dropping practically its entire 120 stamps and is putting through better than 4 tons per day each. Its ore is claimed to run $5 per ton, which is no better than the engineers allowed it in their initial reports. The saving, on plates and by cyanide, is about 95 per cent. of this.

CALIFORNIA

AMADOR COUNTY

Valparaiso—At this mine, near Middle Bar, a rich seam has been found while sinking a new shaft. This same seam has been met at a lower depth also. The mine is being worked by its five owners.

CALAVERAS COUNTY

Clary Gold Mining Company—This company is about to reopen the South Bank mine on Indian creek. Considerable work has been done in the mine, which is equipped with a mill run by electric power.

FRESNO COUNTY

Laurel Hill Group—Considerable development work is being done on the claims of this group on Dinkey creek, 20 miles from Ockenden. The work is being done on small stringer, supposed to lead to the main vein.

INYO COUNTY

New Coso Mining Company—This new company has purchased the Lucky Jim mine, three miles from Darwin. An entirely new shaft will be sunk to develop the property, which at one time was a large producer of smelting ore.

Saline Valley—It is understood that the copper men have made a payment on the Saline valley mines to A. F. Mairs, owner of one of the principal groups.

Sacramento—The first payment on this mine has been made by the Mono Gold Mining Company. The formerly opened Brown & Cowser tunnel in the mine is being extended by contract work.

Southern Belle Mining Company—The new 65-h.p. generator for this mine, at Laws, is being installed. The former power-house has been moved down to the base of the hill, with its wheel and everything complete, except the 10-h.p. generator now displaced. The air compressor will go into service as soon as possible after arrival. Its location in the New Year tunnel will supply air for the mine and the Bullion.

Greenwater District—Present interest is centered in this copper district. The country is full of prospectors, and claims are being staked everywhere. The following list shows the companies already organized, the figures appended showing the capital stock:

Furnace Creek Copper, $3,000,000; Heinze, $200,000; Roger Knox, $150,000; Greenwater Furnace Creek Copper, $100,000; Donellan, $100,000; Copper Cliff, $75,000; Magna Charta, $600,000; Gold Notes, $100,000; Schwab property, $300,000; Ricard, $30,000; United Verde Fractions, $10,000; Nicotine, $25,000; Morning Glory, $75,000; Rambler, $100,000; Blue Jacket, $300,000; Oliver Posey property, $60,000; Calumet & Hecla, $100,000; Undertakers', $50,000; Trade Dollar and Bells, $10,000; Fortune, $75,000; Red Jacket, $25,000; Buster Brown, $40,000; West Side, $75,000; Copper Queen; Neverseen, seven claims; Brook; Kunze; Salsberry, 18 claims; Lisle, 17 claims; Hub, 13 claims; Nippers; Governor, 15 claims; McGinnis; Gladstone; Funeral Range, four claims.

MADERA COUNTY

Ryan-Sym-Ragsdale—This mine, on the San Joaquin river in the Sierra foothills, is developing into a promising property. Three separate tunnels have been driven into the hill. The vein is small but carries good values. Three arrastras have been constructed on the river, about half a mile from the lower tunnel, and a good road built to them from the tunnel. These arrastras are run by a large water wheel upon a flatboat securely held in place by cables, and their combined capacity is seven tons of rock per day. James Smith is in charge and 15 men are employed.

MONO COUNTY

Golden Gale—This mine, Antelope valley, has been bonded by Tonopah and Goldfield men for $80,000. Ten men have been set at work and additional machinery is being provided.

Masonic Mountain Gold Mining Company—This company has bonded the True Friend mine at Masonic mountain and it will be developed at once.

MONTEREY COUNTY

Pleyto Quicksilver Mines—These mines on the end of Bald mountain, 12 miles west of Pleyto, are now being worked with two shifts of men.

NEVADA COUNTY

Eclipse Mining Company—This company at Nevada City is preparing to sink the incline shaft, now down 200 ft. The ejectors heretofore used in raising water are to be replaced by a powerful pump. Operations will be under the superintendency of William B. Simmons.

Deadman's Flat—At this place, west of Grass valley, where a Spokane company owns 60 acres of land, operations for development have been commenced. The new main shaft will be double-compartment, on the Vulcan and Gray Eagle ground.

Union Consolidated Mining Company—This new corporation has purchased the Union Consolidated mine on Banner mountain near Nevada City.

Red Ledge—This property at French corral, formerly worked for gold ore, has finally become a copper mine. Three tunnels have been run, proving the presence of a body of copper ore.

PLUMAS COUNTY

Rush Creek Placer Mining Company—

This company is building a dam at the end of Long valley.

SHASTA COUNTY

Trinity—This company has signed a contract for the delivery of 300 to 1000 tons of ore per day to the Balaklala smelter, which is expected to go into commission next April. The Trinity mines are 2½ miles distant from the smelter. It is probable that an aërial tramway will be constructed for the delivery of the ore. The contract is said to be based on a treatment charge of $3 per ton.

SIERRA COUNTY

Sebastopol—A. G. Hunter has received word to resume work on this mine at Forest. A new tunnel will be run in Reese ravine to crosscut the ledge.

TUOLUMNE COUNTY

Harvard—Sixty men are at work on this mine and 30 of the stamps are dropping.

Omega—This mine, south of the Rawhide, is being developed as a combination quartz and gravel property. This is a paying quartz claim, from which ore is being hoisted through a shaft, one compartment of which is destined to receive the gravel from hundreds of feet away. C. W. Ayers is general manager.

COLORADO.

GILPIN COUNTY.

Aduddell Group—James A. Simmons and associates, of New York, have purchased this property for the reported sum of $80,000. Property is situated in Russell district, and conveyed to the Taawasa Mining Company. A mill has also been purchased at Idaho Springs. Company's office is at Idaho Springs.

Buckley—Omaha, Neb., and Denver people have purchased this property on Gunnell hill and S. T. Harris, Russell Gulch, has been appointed superintendent. They intend sinking several hundred feet.

Gunnell Mines and Milling Company—This is the name of the new company organized to operate the Gunnell mines and mill with Boston capital largely interested, and with A. W. Hogan, Central City, as manager. Work of fixing up the main Gunnell or 1400-ft. shaft is under way and the plant and buildings, which were destroyed by fire two years ago, are to be replaced with a new plant.

Black Hills & Denver—At a recent stockholders' meeting the following officers were elected: President, R. P. Clark; secretary, J. M. Blakeslee, Denver; treasurer, L. A. White, Tolland, Colo. Mr. White is also manager.

Old Town Consolidated—A dividend of $15,000 has been paid to stockholders. A 40-h.p. electric hoist purchased from the J. George Leyner Company, of Denver, is being installed at 1500-ft. level which will be used for hoisting waste and ores during the sinking of the additional 800 ft. of shaft. New ore bins are being built and an ore-washing machine designed by R. B. Morton, of Idaho Springs, to be put in.

Union Exploration Company—Organized with a capital stock of $2,000,000 with Hirsch & Co., of New York, as principals, and owning large interests in Wisconsin district, this company intends to install a compressor plant for driving a tunnel. D. L. Webb, Equitable Building, Denver, is agent.

Druid Mining Company—Scotch people interested have purchased the St. Paul mining claim in Willis gulch. They are making regular shipments to smelters and mills, and have been adding to holdings. J. Anderson, Central City, is superintendent.

Dirigo—Nashville, Tenn., people have purchased this property, consisting of five claims and the Douglass 20 slow drop stamp-mill, situated at Wide Awake, consideration being nearly $40,000, on which a big payment has been made. G. H. Elling, Black Hawk, is manager. The mill is being overhauled and will be run this winter on ores from the tunnel. Company may decide to put in aërial tramway from tunnel to mill next spring and to erect a much larger and modern mill.

Jefferson-Calhoun Mining Company—H. C. Eastman, Central City, Colo., has been appointed manager. Company will put up shaft-building 50x120 ft. on Jefferson shaft and install a 100-h.p. hoist and two boilers, also purchase an air compressor. Chicago people are interested.

LAKE COUNTY—LEADVILLE

Monthly Tonnage—Although the smelter is working all the men that can be had, it is unable to handle the production of the camp, and a few of the principal mines have been closed during the week in consequence. In spite of this serious handicap and other drawbacks, the production for September has been equal to the output for August. The camp generally is in a very flourishing condition. All sections, including Rock Hill, Big Evans, Yak Tunnel, Breece Hill, Carbonate, etc., will increase their shipments in October.

Sugar Loaf—The once famous Dinero on Sugar Loaf mountain is to be opened up again. The Dinero Consolidated Mining and Milling Company has been organized for this purpose. The company has acquired the Dinero and Michigan Boy, an area of about 100 acres. A tunnel is to be driven in over 3000 ft. from the base of the mountain to a point below the old Dinero shaft, to cut a fissure vein which crosses the Dinero lengthwise. The tunnel will also serve to drain off the water, which was the cause of the former shut-down on this mine. The company will put in an electric plant for light and power purposes, and after the completion of the tunnel a mill will be erected to treat the low-grade ore.

Half Moon—The Young America Mining Company, capitalized at $1,000,000, has secured some valuable mining properties in the Half Moon district, and will invest heavily in development work. The company has filed articles of incorporation with James S. Lambie, of Washington, D. C.; William H. Read, of Ohio, and Charles H. Smith, Arthur J. Kibby and Clarence A. Brandenburg, of Colorado, as incorporators and directors. The plans of the company have given a stimulus to mining deals in the Half Moon district during the week, and several important transfers have been made. T. S. Wood sold to C. H. Smith the Iron Duke claim in South Half Moon gulch for a consideration of $5,000. Mr. Smith then turned over to the Young America company his interests in the Iron Duke, and also the Y. A. Mining claims Nos. 1 to 10, and in exchange the Young America company transferred to Mr. Smith the Young America, Buckeye, 16 to 1, and Little Maud lodes in the Half Moon district. The principal offices of the company are located in Denver.

Golden Ibex—Ellis J. Lewis, Walter W. Davis and A. E. Fowlie are the incorporators of the Golden Ibex Mining Company.

Guggenheim—The Guggenheim Zinc Company, a New York concern organized to do business in Colorado, was incorporated in Denver the past week with a capital stock of $1,000,000. Morris Guggenheim is president of the company.

Morning Glory—At a recent meeting of the Century Investment Company in Denver, the owners of the Morning Glory, in Adelaide Park, closed a deal whereby the Yak Mining, Milling and Tunnel Company is to extend its tunnel, or a lateral thereof, to drain the Morning Glory. Operations on this mine have been at a standstill for some time on account of an inflow of water.

Park Range—E. P. Cooper, of Denver, has secured an eight-year lease on the Park range group near the London, and has let a contract for a 200-ft. crosscut tunnel to be driven on the property.

SUMMIT COUNTY

Old Union—Manager Anderson is in Denver, having several test runs made by the various magnetic separating machines on the zinc-iron concentrate product of the Old Union mill. When it has been decided which is the best machine for this work, the company will at once have two or more shipped to Breckenridge and installed in their large mill. J. B. Sherwood, of Ripon, Wis., who is the treasurer of the organization, has been spending some days on the mine. Dr. A. H. Abbott, of Oshkosh, Wis., another director of the company, has also been inspecting the mine and mill.

Blue Flag—This company's mill, on Bald mountain, is now running.

Swan River Placer—J. Parke Channing, of New York, has been in Breckenridge for some days, investigating the results of the drilling tests of the North American Placer ground on the Swan river, which have been going on for the past five months, under the supervision of Mr. Tuttle, of California. This is being done with a view of a sale of the property by New York and London capitalists, a deal instituted by Ben Stanley Revett.

Oro Grande—This placer property, at Dillon, 10 miles west of Breckenridge, is to be sold to the Summit Banner Placer Company. Negotiations are in progress.

TELLER COUNTY—CRIPPLE CREEK

United Gold Mines Company—The transfer of the control of this company from the Woods Investment Company to some of the principal owners of the Golden Cycle Company indicates that the former company is getting out of its interests in the district. The property transferred includes the Wild Horse group, the W. P. H. group, the Battle Mountain Consolidated group and a number of others in different parts of the district. The Aileen and one or two other properties are still retained by the Woods people. The price reported for the transfer of the stock is between $300,000 and $400,000. It is thought that the change in ownership will be beneficial to the district, as the new owners are wealthy and energetic men. It is also rumored that the affairs of the Western Investment Company, which is a heavy leaser in the district, will be closely connected with this property.

Jerry Johnson—The engine-house and machinery on this mine were this week totally destroyed by fire, the loss being about $10,000. The property is situated on Ironclad hill, and has recently been operated under lease by Henry Dahl and associates.

Elkton Consolidated—The affairs of this company are loking very well at present. A large amount of ore is being mined above the water level. A very considerable part of the ore comes from the new vein known as the Henley vein.

Gold Dollar Consolidated—This company recently declared a dividend, being the first for some time. The amount to be paid is $12,500 in all.

IDAHO

SHOSHONE COUNTY

Frisco Mining Company—This company has ordered for its mill six Callow traveling-belt screens, to screen material from 16 up to 100 mesh. The order was placed with the Utah Mining Machinery and Supply Company of Salt Lake City.

INDIANA

Joseph H. Stubbs, State statistician, has made his coal-mining compilation for the year 1905. Comparing these figures with those for 1904, the following growth is shown: The number of mines increased from 17,203 to 18,811; the number employed in the offices decreased from 367 to 313. Contrary to expectation, the total wages of the miners themselves decreased from $9,387,201 to $8,306,206, while the salaries of the office men increased from $501,355 to $635,181. The number of tons of coal mined increased from 9,857,940 to 10,996,170 and the average time of mines in operation decreased from 165 to 150 days.

VIGO COUNTY

Hudson Coal and Mining Company—This company, an Illinois corporation, has been admitted to transact business in Indiana, with headquarters in Terre Haute.

MICHIGAN

HOUGHTON COUNTY—COPPER

Calumet & Hecla—Five of the heads which are at present undergoing remodeling at the Calumet & Hecla mill are being prepared to stamp amygdaloid rock. It is expected that the heads will be in service about next May.

Osceola—The North Kearsarge shaft, which has been closed on account of fire, was opened this week and parties went underground. It is not reported whether the fire is entirely out, but there is nothing to indicate that it is still burning.

IRON—MENOMINEE RANGE

Maas—At this new mine, near Negaunee, the Cleveland Cliffs Iron Company is active in the erection of buildings and the placing of machinery that will make the mine a large producer at an early date. There will be boiler capacity of 1000 h.p., the plant fitted with fuel economizers, mechanical stokers and induced draft. Coal will be received automatically at the stokers and ashes will also be handled automatically. There will be two hoists, one for ore and one for men—one a first-motion and the other a second, both Corliss type. There will be a 50-drill compressor and an electric haulage system, the latter not until the mine has been more completely opened, however. It is expected the surface plant will be ready for operation before January, and the mine will be producing largely next year. It is about five years since development was commenced on this property and 22 months were spent in getting the shaft to ledge. In this and other respects it has been the most notable work ever undertaken in the Marquette region.

Rolling Mill Mine—In this mine at Negaunee the company is cutting a plant at 620 ft. and will drive to ore, which has been cut. It is an excellent ore to mix with the characteristic Mesabic ores.

MINNESOTA

Shipments of iron ore from the Mesabi and Vermillion ranges for the season up to Oct. 1 are given by the dock records as below, in long tons:

	1905.	1906.	Changes.
Duluth	6,719,506	8,251,046 I.	1,531,540
Superior	3,919,731	4,448,174 I.	528,443
Two Harbors	6,024,148	6,289,875 I.	265,727
Total	16,663,385	18,989,095 I.	2,325,710

The shipments in the month of September were 3,770,133 tons, an increase of 879,682 tons over September of last year.

IRON—MESABI RANGE

Hill Ore Lands—The long pending negotiations for the lease of the iron-ore lands on the Mesabi range, owned by Jas. J. Hill and the Great Northern Railway Company, have finally been concluded. The transfer is to be by rental on a royalty basis, the price to be varied slightly according to the quality of the ore. The base price is to be $1.65 per ton, including transportation to Lake Superior, the Great Northern securing the haul on all ore mined from these lands. It is understood that of the $1.65 per ton rental 80c. represents the transportation charge and 85c. the royalty. This price is to increase by 3.4c. per year, which is 4 per cent. on the royalty. The minimum fixed for 1907 is 750,000 tons; and this minimum is to increase by 750,000 tons each year, until 8,250,000 tons is reached, which will be in 1918.

Some comments on this lease will be found on another page.

Stevenson—Messrs. Corrigan, McKinney & Co., of Cleveland, Ohio, write as follows, under date of Oct. 2: "In the issue of the JOURNAL of Sept. 29, we note a statement as follows: 'The Stevenson has sold a block of its ore for this fall's delivery, within the last three weeks, at $4.60 per ton.' This statement is incorrect, as no Stevenson ore has been sold within the past three weeks, or within the past three months for that matter, at $4.60 or any other price."

Oliver Iron Mining Company—This company is making extensive purchases of material for mine operation the coming year, especially for the western Mesabi operations into which it is now going so extensively. These purchases include 22 steam shovels, of about 90 tons weight each, 30 locomotives and several hundred self-dumping standard-gage stripping cars. A large amount of new machinery for underground mines, in the way of hoists, compressors, pumping engines, etc., will be purchased as needed. The work of the company for the coming year will be very largely directed to opening and enlarging already open stripping mines on the Mesabi and to developing the new fields in the western end of that district. Coleraine, Bovey and Holman mines, as well as others about six miles east of there, will be extensively stripped, and large operations will be carried on at Virginia, in the Oliver and Ohio groups, as well as at the new Gilbert mine, near Sparta. The sinking of deep footwall shafts, steel lined and expensively equipped, on old ranges, will be continued where necessary and in preparation for very large and economical mine operations whenever needed.

MISSOURI

JASPER COUNTY

Burch Land—The Burch land at Duenweg, east of Joplin, which has been a small producer of lead and silicate for years, is just now attracting the attention of prospectors. Years ago J. W. Burch sunk a shaft on his land with the hope of finding ore in such quantities that it would pay to mine, and at a depth of 80 ft. some lead shines were encountered, but on sinking several feet farther no ore showed and the shaft was abandoned. A short time ago Mr. Burch leased this same piece of land on which the shaft was sunk to the Allen Mining Company. They went into the old shaft and began drifting. When only a few feet from the shaft, they found lead in large quantities and now at 30 ft. from the shaft they have a 14-ft. face of lead ore.

Log Cabin Lease—The Saddle Horse Mining Company, composed of George Donnellan, Otto Duenweg, George Strain and others, operating on a sub-lease of the Log Cabin lease at Duenweg, has made a rich strike of lead in a drill hole. The drill encountered the ore at 40 ft. and continued in it to a depth of 82 ft. Work will be commenced at once sinking a shaft; drilling will be continued to test the lease.

Stith Land—The discovery of a vein of lead ore at a depth of 70 ft. on the Stith land, five miles northwest of Carthage, has caused some excitement. The discovery was made last week by some Springfield parties who recently secured a lease on the land.

Corwin Land—A company of Joplin parties has secured a lease on 160 acres of the Corwin land, situated south of Carthage and near Center creek. The first hole made encountered a 9-ft. face of ore below the 140-ft. level, and more or less mineralized ground down to the 200-ft. level.

Duenweg—A. P. Clark and others, of Joplin, have secured promises on a lease of 420 acres of land south of Duenweg, on which they propose to do 20,000 ft. of drilling.

MONTANA

BUTTE DISTRICT

Original—This company is sinking a three-compartment shaft on the west end of the Elm Orlu, for the purpose of developing the vein that traverses the claim, and also the Poser, adjoining on the west. The depth to which it will be put down has not been fully determined, but it will likely be 1500 or 2000 ft. Copper ore is coming from an opening on the Poser, and it is said that a vein 100 ft. wide has been tapped by a diamond drill in the property. This vein extends into the Valdemere, an Alice Company mine adjoining the Poser on the west.

La France—This company is still tanking water from the lower openings of Lexington ground, and has drained to the 1100-ft. level. It has 365 ft. to drain, including extensive openings below the 1100. A portion of the Alice workings has been drained in the work; for the two, although a third of a mile apart, are connected by the crosscut on the 700 of the Alice and 600 of the Lexington.

Lewisohn General Development—This company has decided to sink a deep shaft on the Granite Mountain, a claim lying between the Jessie and Edith May, of North Butte. It is still developing ground on the east side of the district, but has not struck ore in commercial quantities there.

NEVADA

EUREKA COUNTY

Richmond-Eureka—The capital stock of this company will be increased by the issue of 40,000 additional shares, making the total 400,000 shares. Stockholders have the right to buy the new stock pro rata at the rate of $6 per share. Shipments of 50 to 100 tons of ore per day are being made to the United States smelter, near Salt Lake City.

LINCOLN COUNTY

Gold Butte—The Post Office Department at Washington has advertised for bids for mail service three times a week to Gold Butte, where considerable mining activity is in evidence. The camp is situated in the southeast corner of Lincoln county.

LYON COUNTY

Nevada Douglas Copper Company—This company, which has headquarters in Salt Lake City, is developing mining property near Yerington. It has entered into a 10-year contract with the Truckee Electric Power Company of Reno for power to supply the mines and contemplated reduction works. The company intends to proceed to provide its mine with heavy equipment. Walter C. Orem, of Salt Lake City, Utah, is manager.

Ely Consolidated Copper Company—This is the name of a new corporation just launched in Salt Lake City. W. G. Filer is president; W. F. Snyder, vice-president; Gideon Snyder, secretary and treasurer. The company has acquired property at Ely, Nevada.

Nevada Northern Railroad—The railroad to Ely, Nevada, is completed. The ceremonies attending the driving of the last spike were held in the presence of hundreds of visitors. The new road leaves the main line of the Southern Pacific at Cobre, a station about 150 miles west of Ogden, and follows down the Steptoe valley, tapping the camps of Cherry Creek and Duck Creek and bringing other mining districts into closer range, which has been followed by a general revival in the region tributary to it. Ely, by the present rail route, is 319 miles from Salt Lake City, while on an air line it is not to exceed 175 miles. Engineers are already in the field and the probability is that the San Pedro, Los Angeles & Salt Lake Company will build a more direct route at no distant day. The Nevada Copper Company will now proceed to award contracts for building material and equipment to be used in the construction of the proposed concentrating mill, which is to have capacity for the treatment of 5000 tons of ore per day, and also a smelter to handle one-fifth the amount stated. The contract—that is, for equipment—is to be awarded from the head offices of the American Smelting and Refining Company and this particular department will be under the supervision of Mr. Karl Eilers.

NEW MEXICO.

GRANT COUNTY.

The old camp of Pinos Altos is being gradually rejuvenated under the inspiration of the Comanche Mining Company, which bought the Hearst holdings two years ago. A narrow-gage railroad, for the use of a Shay locomotive, has been completed from Silver City to the Hearst and Gillette shafts and will soon be extended to the edge of Pinos Altos village. Both the Mammoth and Stanley mills are making concentrates for shipment to the Silver City smelter. At Cuchillos, near Edwards, the Comanche Company has been sinking a shaft to be ultimately 700 ft. deep and on its claims near Leopold, in the Burro mountains, it is planning to increase the working force.

Burro Mountain District—The Briggs-Oliver Development Company, backed by New York and Philadelphia capital, has bought the Burro Chief property from Thomas Parker, and by the aid of steam hoists is sinking one three-compartment and two two-compartment shafts. It will crosscut from them sufficiently to thoroughly explore the ground. To the eastward, the Copper Gulf Company owns 125 acres and has a 100-ft. shaft equipped with a 20-h.p. hoist, which it expects to continue to the 300-ft. level. The adjoining Tip Top and Alessandro companies are developing, and the latter is shipping high-grade copper carbonate. The Azure Turquoise Mining Company has a new steam-hoisting equipment, and will proceed to open up the newly discovered copper orebody. At Malone, north of Lordsburg, the International Company is planning to complete the cyanide plant and run the mine dumps through it.

NEW YORK

The amended labor law, which went into effect Oct. 1, requires all persons or corporations operating mines or quarries to file reports with the Labor Commissioner of the State, showing the nature of the operations and the names of the owners and operators. The law forbids the employment in any mine, or in any

quarry more than 25 ft. deep, of boys under 14 years of age, or of any woman or girl.

NORTH DAKOTA

MCLEAN COUNTY

Wilton—This coal mine, at Wilton, has been closed, owing to fire in the workings. In spite of all efforts, the fire has continued to spread. The mine is owned by W. D. Washburn, of Minneapolis.

PENNSYLVANIA

ANTHRACITE COAL

Beaver Brook—The new washery of C. M. Dodson & Co., at Beaver Brook, has been placed in operation.

Ellangowan Colliery—A new 70-ton steam shovel has been received at the Ellangowan colliery, Shenandoah, for use in the strippings, making two machines of the same size in use there. It is proposed to drive the strippings northward several hundred yards, to strip the loose coal on the mountains. There is work for 10 years at the strippings.

Natalie Colliery—This colliery, near Mt. Carmel, is to be re-opened. It was sold under foreclosure, and arrangements have been made for a resumption. It employs about 700 men and boys. The mine has been idle for two years.

Pine Hill Coal Company—This company has secured a lease of the Herbein coal tract, near Pottsville, for a period of 15 years, at an annual rental of $10,000, together with royalties ranging from 40c. per ton on finished coal.

Enterprise—This colliery, near Shamokin,which has been shut down since Oct. 15, 1904, owing to fire in the workings, resumed operations this week, and is now hoisting about 150 cars a day.

Kaska-William—Operations have been resumed at this colliery, near Kaska, after an idleness of two months, during which time new openings have been made to the various seams. This operation has frequently been abandoned, it being thought that the coal was exhausted. It will now enjoy a new lease of life.

Mary D.—The new breaker at this colliery is nearly completed, and a date will soon be set for starting up.

Woodward—A new slope is being driven at this mine of the Lackawanna company, which will work the vein which crops out on Woodward hill.

BITUMINOUS COAL

Many transfers of coal property have recently been recorded, among which the following are important:

Bessemer Coke Company—This company has bought from the Millsboro Coal Company, of Pittsburg, 105 acres of coal land on Two-mile creek in Washington county. The consideration is $110,000 in bonds.

Gayman—The Gayman tract in Washington county has been sold to W. R. Hawkins and R. L. Hoskins for $500 an acre. It includes 60 acres, adjoining the property of the Pittsburg-Buffalo Company, near Zollarsville.

Jamison Coal Company—This company has bought the coal rights on the Burnhart property, 250 acres, near Hemfield, in Westmoreland county. The price is reported to be $1000 per acre.

TENNESSEE

LINCOLN COUNTY

Elk Mining Company—This company is developing a new phosphate property at Kelso, and is already making shipments. Jesse M. Littleton, Winchester, Tenn., is president; Isaac W. Crabtree, Winchester, secretary and manager; J W. Lowman, Kelso, superintendent.

POLK COUNTY

Tennessee Copper Company—The new smelter, which cost about $700,000, is now running at full capacity, and the output of the company is between 1,300,000 and 1,400,000 lb. of copper per month. It is expected that the output will be increased to about 1,500,000 lb. per month when sufficient labor can be secured.

UTAH

JUAB COUNTY

Tintic Ore Shipments—Last week's output amounted to 123 carloads, the shippers and amounts being: Beck Tunnel, 7; Bullion Beck, 7; Carisa, 4; Centennial Eureka, 30; Dragon Iron, 9; Eagle and Blue Bell, 4; Eureka Hill, 7; Gemini, 4; Godiva, 2; Grand Central, 9; Lower Mammoth, 4; Mammoth, 15; Ridge and Valley, 2; May Day, 1; Scranton, 4; Victoria, 6; Uncle Sam Consolidated, 8; Swandea, 2; Yankee Consolidated, 2 carloads.

Gemini—Recent development on the lower levels of this mine has been productive of good results. The physical condition of the mine is better than it has been in a long time.

SALT LAKE COUNTY

New England Gold and Copper—This Bingham company is doing some interesting development work. Several new oreshoots of importance have recently been opened. The mill, with which the mine is equipped, is being run only one shift, energy being centered mainly on mine development at the present time.

Ohio Copper—An official of this Bingham company has made the statement that there is at least seven years' ore supply blocked out in this property, using the present basis of production—200 tons a day.

SUMMIT COUNTY

Park City Shipments—Last week the mines of Park City shipped 4,450,760 lb. of ore to the Salt Lake smelters, the shippers and amounts being: Daly Judge, 1,669,000; Silver King, 1,344,760; Daly West, 900,000; Little Bell, 392,000; Ontario, 102,000 pounds.

Uintah Treasure Hill—This company has acquired some additional territory which will prove important in the future.

Great Western—Ore of a fair grade has been encountered in the tunnel being driven on this property.

WASHINGTON

OKANOGAN COUNTY

Phil Sheridan—Wm. A. Potter, of Peoria., Ill, purchased a one-half interest in the Phil Sheridan group two years ago, and took a bond on the remainder, which he has since purchased. The group was incorporated, and has since been developed by the Phil Sheridan Mining and Milling Company, under Mr. Potter's management. A shaft had been sunk 75 ft. on the vein, and since then a crosscut has been driven 220 ft., at a depth below the surface of 106 ft. An upraise of 31 ft. has connected the tunnel with the shaft, and a drift 27 ft. long has been driven on the vein. The face, 4 ft. wide, is all ore. Another tunnel was started, which practically followed the vein 30 ft. No. 3 tunnel is in 116 ft., and is expected to tap the vein 152 ft. lower than the No. 1 tunnel. Test shipments to the Granby smelter have given good returns.

Samuel McEachen and Thomas Gordon, of Scranton, Penn., stockholders in the company, are at the mine, which is situated on the south slope of Eneas mountain, in the Galena district, 18 miles south of Loomis.

WEST VIRGINIA

J. W. Paul, chairman of the commission to revise the State mining law, has issued the following notice to the mine operators and mine employees of West Virginia:

"In pursuance with the direction of the Governor of the State, Hon. Wm. M. O. Dawson, the Mining Commission has met and gone over the present laws of the State and reviewed the conditions as they have been presented as existing throughout the mining sections of the State, and has formulated a number of amendments to the law. In order that the work of the commission may be presented for discussion to the interests affected, the commission has taken an adjournment to reconvene in the Senate Chamber, in the City of Charleston on Oct. 16, at 10 a.m., and an invitation is extended to the operators and mine employees of the State to meet the commission at that time.

WISCONSIN

ZINC DISTRICT

Frontier—The work of unwatering the Frontier has been started. A compressor outfit has been ordered, consisting of a Rand Imperial type XI machine, with complete drill equipment.

Winnebago Mining Company—The old Hoskins is about ready to produce ore under its new name and management. Four new Ingersoll drills have been purchased, and a new force of miners employed.

Foreign Mining News

CANADA

ONTARIO—COBALT

The event of the week in mining and financial circles has been the acquisition of a controlling interest in the Foster-Cobalt Mining Company by a syndicate of Toronto, Montreal and American financiers. The company is capitalized at $1,000,000, in $1 shares, and it is stated that the syndicate purchased 600,000 shares for about $900,000. It is understood that W. K. George, of Toronto, will be president of the company. This transaction is likely to be followed by other transfers of properties of recognized value to large corporations which can command capital to develop them thoroughly, and will conduct operations on a more systematic and extensive scale by means of improved machinery. Several properties are said to be under option to prospective buyers, representing large interests.

AFRICA

GOLD COAST

Official returns give the production of gold in West Africa, or the Gold Coast, in August at 16,318 oz. For the eight months ending Aug. 31 the total was 104,301 oz. gold in 1905, and 135,517 oz. in 1906; an increase of 31,216 oz. this year.

Coal Trade Review

NEW YORK, Oct. 10

In the East the coal trade is generally quiet, and there is nothing new except the usual spurt in the coastwise trade to get supplies to the Northern ports before cold weather closes them.

In the West the car supply and railroad transportation are the main factors in the market for the time being. There is some local improvement, but frequent complaints about insufficient transportation continue to be heard, and it is feared that these will increase as winter approaches.

COAL TRAFFIC NOTES

Shipments of coal and coke originating on the Pennsylvania Railroad Company's lines east of Pittsburg for the year to Sept. 29 were as follows, in short tons:

	1905.	1906.	Changes
Anthracite	3,404,442	3,240,710	D. 163,732
Bituminous	21,725,597	23,601,756	I. 1,876,159
Coke	8,153,901	9,369,141	I. 1,215,240
Total	33,283,940	36,211,607	I. 2,927,667

Shipments of Nova Scotia coal, by companies, for the eight months ending Aug. 31 are reported as follows:

	1905.	1906.	Changes.
Dominion Coal	1,823,767	2,092,675	I. 268,908
N. S. Steel	342,629	411,463	I. 68,834
Cumberland	261,791	283,325	I. 21,534
Intercolonial	119,674	190,605	I. 70,931
Acadia	162,570	168,355	I. 5,785
Inverness	79,957	117,305	I. 37,348
Total	2,790,388	3,263,728	I. 473,340

The total gain in shipments this year was 17 per cent.

The coal tonnage originating on the Southern Railway for the seven months ending July 31 was, in short tons: Tennessee district, 934,849; Alabama district, 1,062,393; total, 1,907,242 tons.

Shipments of Broad Top coal over the Huntingdon & Broad Top Railroad for the week ending Oct. 6 were 16,099 tons; for the year to Oct. 6 they were 585,603 tons.

The Chesapeake & Ohio Railway reports coal tonnage for the two months of its fiscal year from July 1 to Aug. 31 as below, in short tons:

	Coal.	Coke.	Total.
New River	825,414	26,412	851,826
Kanawha	555,410	11,537	566,947
Kentucky	17,528	.....	17,528
Connecting lines	80,800	13,206	94,006
Total, 1906	1,479,152	51,155	5,530,307
Total, 1905	1,335,195	63,856	1,399,051

The totals show an increase of 143,957 tons of coal, and a decrease of 12,701 tons coke. The shipments originating on the line were distributed as follows: Points west of mines, 699,040 tons coal and 27,272 tons coke; points east 233,306 tons coal and 10,677 tons coke; tidewater, 466,006 tons coal.

New York Oct. 10

ANTHRACITE

The hard-coal market remains simply and purely influenced by the weather. A few cool days recently brought out a little activity, but the market is now as quiet as before. This may be expected to continue until winter sets in. Shipments of hard coal in September were 4,527,886 short tons, a decrease of 555,346 tons from September of 1905. The total to Oct. 1 this year was 35,767,760 tons, as against 45,388,810 tons in the nine months of 1905. Prices remain at $4.75 for broken and $5 for egg, stove and chestnut; for steam sizes, $2.80@3 for pea; $2.25@2.50 for buckwheat; $1.45@1.50 for rice; $1.30@1.35 for barley; all f.o.b. New York harbor shipping points.

BITUMINOUS

There is some improvement in the Atlantic seaboard soft-coal trade, but not as much as had been expected. The increased output is only as much as the shortage of railroad cars will permit; any further increase at this time would accumulate in the hands of shippers until better transport could be arranged. Consumers with contracts are beginning to put in their winter supplies and business in the shoal-water ports is being closed up as rapidly as possible. There is a heavy demand for ¾-in. West Virginia gas coal from the West, especially at lake ports.

Trade in the far East shows a moderate increase, but shipments are much restricted by the recent heavy winds. Large numbers of vessels are held in harbors. The Sound is becoming more active, now that car shortage is well developed, and is calling for more coal. Trade in New York harbor is quiet. Standard steam coals are sold for $2.60@2.70 f.o.b. harbor shipping points; there is little or no new business. All-rail trade shows a heavier demand and firmer prices.

Transportation from mines to tide is irregular and somewhat slow. Car supply is limited on all roads; the Pennsylvania offers the largest number. Vesels in the coastwise market are in short supply, owing to the bad weather. Current rates from Philadelphia are as follows: To Boston, Salem and Portland, 65@75c.; to Lynn and Newburyport, 85c.; to Portsmouth and Bath, 75@80c.; to Bangor, 80@85c.; to the Sound, 60c.; to Saco, 90c.; to Gardiner, 85@90c. and towages.

Birmingham Oct. 8

The interruption to railroad traffic has had its effect on coal production in Alabama. There is a strong demand for coal and the various companies are doing all they can to keep mines in operation. The excessive rains caused a stoppage of work at several mines, but the loss in general production will not be as extensive as might be thought.

Considerable improvement is being made in mines throughout Alabama. The Bessemer Land and Improvement Company is opening its No. 5 mines and already a little coal is being mined there. All the mines of this company are being equipped with electrical haulage. The Pratt Consolidated Coal Company expects to be able shortly to start active work developing coalfields in the western part of Jefferson county to which section the Louisville & Nashville railroad has constructed a branch.

Coke is still in great demand. The production could be increased 30 per cent. and then not fill the entire demand.

Chicago Oct. 8

Improvement in the wholesale coal market, though slow, is perceptible. Notwithstanding the shortage of cars everywhere complained of, the needs of users of Illinois and Indiana bituminous—the great bulk of the trade—are fairly supplied. Fine coals, indeed, continue in too plentiful supply and many consignments are sold at no profit. Screenings are sold at 75c.@$1; run-of-mine at $1.50@1.90, and lump and egg at $2@2.50. The usual tendency of the season is apparent in the greater demand for prepared sizes and a falling off in the demand for fine coals.

Business outside Chicago continues better than within the city, and the car scarcity has had the effect of preventing the usual accumulations of coal that have to be sold at ruinous prices to escape demurrage.

Eastern coals are firm as a result of the car shortage, but receipts of smokeless, Hocking and other Eastern coals are reported better than a week ago. Smokeless continues to profit locally out of the city's prosecution of violators of the anti-

smoke ordinance. Youghiogheny is still scarce, with three-quarter quoted at $3.30.

Anthracite is not yet in active demand by consumers, and until the consumer becomes interested in his winter's supply the retailer will remain out of the market.

Cleveland Oct. 9

The coal market in this territory is still governed mainly by the movement of cars. This is especially apparent in the lake trade, where the situation is acute. The shipments have been slower than the season warrants. This is due to the fact that cars cannot be had to keep the mines running. It is easy enough to get small cargoes, but large cargoes are practically out of the question and big boats tied up on contracts are delayed, while others are running up light.

The price of coal is influenced by the short supply on the market. The best grades of mine-run steam coal are now selling at $1.05@1.10 at the mines, in both the Ohio and the Pennsylvania district; while the price of slack rules between 65 and 75c. at the mines. The supply is getting a little shorter, with the slackening of the production of Lake three-quarter coal.

The coke situation is strong. The demand for furnace coke has been exceptionally heavy, and a shortage seemed possible. Some buyers have already come into the market and placed orders for delivery through the entire year 1907, while the price for first half was advanced to $3.25. The best grades of 72-hour foundry coke are selling at $3.75 at ovens.

Pittsburg Oct. 9

Coal—The car supply shows a slight improvement this week, but the mines are not being operated to more than 60 per cent. of their capacity, except the river mines, which are practically running full. There was a sufficient rise in the rivers this week to let in a number of empty coal barges and flats which were sent up to the pools and will insure steady operation of the river mines and a large tonnage for shipment to the lower ports when the rivers are again navigable. The rains this week, it is believed, will permit some coal to go out in a few days. Prices remain firm on a basis of $1.25@1.35 a ton for mine-run coal at the mine.

Connellsville Coke—The minimum price of standard Connellsville furnace coke this week is $3 a ton, and for delivery next year $2.75@3 is quoted. Sales of foundry coke have been made at $3.75 for delivery this year and it is doubtful if this rate can be shaded. For next year $3.60 is named as the minimum price for foundry coke. The production in the Connellsville region, according to the *Courier*, amounted to 278,624 tons, a slight gain over the previous week. The shipments aggregated 15,729 cars distributed as follows: To Pittsburg, 4905 cars; to points west of Pittsburg, 8956 cars; to points east of Connellsville, 1868 cars. This was an increase in shipments compared with the previous week of 1634 cars. The production in the Lower Connellsville region amounted to 109,909 tons.

Foreign Coal Trade

Oct. 10

Exports of coal and coke from the United States for the eight months ending Aug. 31 are reported by the Bureau of Statistics of the Department of Commerce and Labor as follows:

	1905.	1906.	Changes.
Anthracite	1,574,721	1,472,459	D. 102,262
Bituminous	4,549,837	4,894,707	I. 344,870
Total coal	6,124,558	6,367,166	I. 242,608
Coke	396,150	515,777	I. 179,627
Total	6,520,708	6,882,943	I. 362,235

The coke went chiefly to Mexico; some was also exported to Canada, chiefly to Ontario. The distribution of the coal was as follows:

	1905.	1906.	Changes.
Canada	4,679,455	4,726,233	I. 46 778
Mexico	591,569	765,789	I. 174,220
Cuba	323,229	439.682	I. 116,453
Other W. Indies	196.955	220,966	I. 24,011
France	2,846	2,155	D. 691
Italy	56,951	45,601	D. 11,350
Other Europe	18,037	20,910	I. 2,873
Other countries	255,516	145,830	D. 109,686
Total	6,124,558	6,367,166	D. 242,608

The coal reported under other countries went chiefly to South America. Canada took this year 68.7 per cent of the total shipments of coal. The exports to Canada in detail were:

	1905.	1906.	Changes.
Anthracite	1,582.752	1,446,031	D. 106.721
Bituminous	3,126,703	3,280,202	I. 153,499
Total	4,679,455	4,726,233	I. 46,778

The net increase this year was only 1 per cent.

Imports of coal and coke into the United States for the eight months ending Aug. 31 were as follows:

	1905.	1906.	Changes.
Canada	859,870	1,021,993	I. 162,123
Great Britain	3 ,691	76,917	I. 46 226
Japan	41,636	11,726	D. 29 910
Australia	108,438	121,493	I. 13,055
Other countries	250	4,173	I. 3,923
Total coal	1,040,885	1,236,302	I. 195,417
Coke	29 172	86,234	I. 57 062
Total	1,070,057	1,322,536	I. 252,479

Of the coal imported this year 11,909 tons were classed as anthracite. With the exception of some Nova Scotia coal which comes to New England ports, most of the coal is received on the Pacific Coast. Coke was not reported separately prior to July 1, 1905. A few thousand tons of coke come from Germany; the rest is from British Columbia.

Iron Trade Review

New York, Oct. 10

The iron and steel trades continue active, with no present foreshadowing of any reaction. The buying of pig iron has fallen off, but chiefly because consumers have supplied their present needs, while furnaces have little iron left to sell for the next six months.

Finished material continues to be called for on new contracts. Railroad equipment orders are large, and new building projects are again coming forward freely. In fact, there seems to be no end to them. The machine shops, also, both large and small, are full of work and taking material.

The great topic of discussion is the final closing of the Hill ore-land deal with the United States Steel Corporation. The terms of the contract, and some comment upon them, will be found elsewhere in this issue.

Exports and Imports—Exports of iron and steel, including machinery, from the United States during the eight months ending Aug. 31 are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1905.	1906.	Changes.
August	$12,562,542	$15,309,057	I. $2,746,515
Eight months	90,768,479	113,299,535	I. 22,531,056

The increase for August was 21.9 per cent.; for the eight months, 24.8 per cent. The chief items of the iron and steel exports for the eight months were, in long tons:

	1905.	1906.	Changes.
Pig iron	33,763	50 576	I. 16,813
Billets, ingots & blooms	126,624	162,459	I. 35,835
Bars	36,136	56,582	I. 20.446
Rails	190,068	232,072	I. 42,004
Sheets and plates	42,676	69,050	I. 26,374
Structural steel	50,004	74,606	I. 24,602
Wire	89.855	112,449	I. 32,594
Nails and spikes	33,702	42.941	I. 9,239

The chief exports of rails this year were South America, 83,360 tons; Canada, 64,039; West Indies, 25,905; Mexico, 17,062; Central America, 17,416 tons.

Imports of iron and steel, including machinery, into the United States, for August and the eight months ending Aug. 31, were valued as below:

	1905.	1906.	Changes.
August	$2,318,680	$2,623,677	I. $304.997
Eight months	17,411,628	21,544,688	I. 4,133,060

The increase for August was 13.2 per cent.; for the eight months, 23.7 per cent. The chief items of the iron and steel exports for the eight months were, in long tons:

	1905.	1906.	Changes.
Pig iron	126.815	203,165	I. 76,350
Scrap	8 269	10,303	I. 2,034
Ingots, blooms, etc.	9,540	13,688	I. 4,148
Bars	22,946	23,576	I. 630
Wire-rods	11,335	12 202	I. 867
Tin-plates	50,329	31,944	D. 18,385

The pig-iron imports, though they show a large proportionate increase, were small in total quantity, and do not indicate that there has been much buying abroad.

Iron Ore Movement—Exports and imports of iron ore in the United States for eight months ending Aug. 31 were as follows, in long tons:

	1905.	1906.	Changes.
Exports	131.944	184,973	I. 53,029
Imports	588,526	737,660	I. 149,134

Most of the exports go to Canada, while the imports are chiefly from Cuba.

Imports of manganese ore for the eight months were 186,206 tons in 1905, and 140,863 tons in 1906; a decrease of 45,343

tons. These imports are chiefly from Russia and Brazil.

Birmingham Oct. 8

The Alabama pig-iron market shows continued firmness and quotations are inclined to take an upward turn. Almost all the trading is for iron to be delivered during the first half of 1907. Prices for spot iron are strong, but there are but few sellers, though $17 per ton, No. 2 foundry, is quoted for spot. The quotations for the first six months of the coming year range around $16 per ton, No. 2 foundry, basis. A number of inquiries are again in the market and the furnace companies state that they are having no trouble in disposing of their iron for next year.

The steel plant at Ensley is working on full time. The Southern Steel Company has all its plants, those at Gadsden and those at Ensley, on double turn. The demand for wire and nails is strong. The Southern Steel Company is putting in continuous wire machines in the Ensley plant. Work on the new plant of the Tennessee Coal, Iron and Railroad Company adjacent to the present plant at Ensley has been stopped by the heavy rains during the past week.

Chicago Oct. 8

The demand for pig iron continues quiet and steady, with no change in prices for future deliveries, but a continuation and perhaps increase of the demand for quick-delivery lots. This situation is in part due to delayed deliveries by Northern and Southern furnaces, but in part also to larger demands on the melters. Small lots for quick delivery are scarce and growing scarcer. The supply is greater of Southern than Northern, and premiums on both are paid willingly whenever a lot is picked up. There is a fair sale of iron for delivery next year.

Local business in iron and steel products continues very good, and all indications are for continued firmness of the market.

Southern iron is quoted at $15.50@16 Birmingham ($19.40@19.90 Chicago), and Northern at $20@20.50. These prices obtain on the greater part of contract business, but reports are current of their being shaded 25@50c. on favorable contracts.

Cleveland Oct. 9

Iron Ore—The movement of iron ore down the lakes for September amounted to 5,429,660 tons, an ncrease over September last year of 1,009,110. The movement to Oct. 1 was 28,150,755 tons, an increase over the corresponding period a year ago of 2,678,149 tons. This assures a movement for the year of over 36,000,000 tons by the lake route compared with 33,400,000 tons a year ago.

Pig Iron—The market is exceptionally strong and foundry is scarce. No. 2 Northern is now sold at $21 southern Ohio furnace for this year's delivery and $17.50 Birmngham is asked for Southern No. 2. Northern furnaces have no present production to sell, but some are selling off stock-piles created for speculative purposes. The same grade is selling at $19 to $19.50 in the Valleys for second quarter delivery. There is practically none for first quarter shipment. Bessemer is held conservatively at $19 and basic at $18.75 in the Valleys.

Finished Material—The resumption of the American Ship deal to buy Ship Owners' Dry Dock promises an order before the week is out for eight new boats. Deliveries on shapes are slow and some buyers, to get quick delivery, are going to Eastern mills, paying a premium of $2.50. Sheet-bars and billets are scarce and small mills are suffering.

New York Oct. 10

Pig Iron—The market is strong and the sales of foundry have been larger; on the other hand, basic iron has quieted down. There is rather a wide range of quotations, the lower prices given below being for next year contracts, while the higher figures are for delivery in November and December.

Current quotations for pig iron are for New York or parallel delivery:

Northern:	
No. 1 X foundry	$21@$22.50
No. 2 X foundry	20.50@22
No. 2 plain	19.75@21
Forge pig	17.50@18
Southern:	
No. 1 foundry	20.75@21 50
No. 2 foundry	20@20.75
No. 3 foundry	19@19.75
No. 4 foundry	18.25@19
No. 1 soft	20.75@21 50
No. 2 soft	20@20.75
Gray forge	17.25@18
Basic pig:	
Northern	19.50@20
Virginia	19.25@19.75
Alabama	20@20.50

City or local deliveries are not included in price, which are for large lots, on dock or cars.

Bars—Bars are higher, at 1.745c. tidewater, for common iron, and 1.795c. for refined. Steel bars are quoted at 1.645@1.745c., according to size and conditions of orders. Store trade is steady at 2.50c. delivered.

Structural Material—More work is coming forward. San Francisco orders are beginning to have some effect. Beams and channels are quoted at 1.845c., tidewater; deck beams, 1.995c. Beams and channels in smaller quantities are 2.25@2.50c. out of stock.

Rails—Standard rails are unchanged at $28. Light rails are in good demand. Some orders for trolley rails for next spring are coming forward.

Old Material—Prices are still high, especially for steel scrap. No. 1 railroad wrought is $20.50@21.50; No. 1 yard wrought, $19.50@20.50; machinery cast, $16.50@17; heavy steel melting scrap, $17@18. Prices are for delivery at wharf or railroad terminal.

Philadelphia Oct. 10

The chief features of the pig-iron market for the past week or so have been the enormous purchases of basic pig during the latter part of last week and the sudden falling off in demand for the first three days of this week. Another interesting feature is the large orders that have recently been placed for English and Scotch iron for earliest possible delivery. Some of our larger pig-iron consumers in eastern Pennsylvania have recently placed contracts with Southern furnaces, especially for No. 2 iron for delivery during the first half of next year. All other kinds of pig iron are stronger and there is considerable anxiety shown by a number of our local consumers and of consumers throughout eastern Pennsylvania to make sure of iron for consumption during the early months of next year.

Steel Billets—Steel billets are extremely scarce, hard to contract for and higher in price. Premium prices have been quietly offered in several instances and prices have been quoted this week as high as $33 for rolling billets. There is also an active demand for forging billets with prices running around $37 to $39 and occasionally a little higher.

Bars—Merchant bar iron has advanced in price, more because of the urgent requirements of small buyers who found themselves in a corner and had to fix their own prices to get the iron. Steel bars have also advanced and quotations are next to impossible, although 1.88½ may be given as a fair quotation for small lots.

Sheets—There are indications that the card rates will be advanced some $2 per ton because of the difficulty of making satisfactory deliveries.

Structural Material—The oversold condition of the structural mills of this State is disturbing a number of contractors and engineering concerns.

Scrap—The scrap market has quieted down slightly, but there is nothing actually new. Buying is restricted to necessary requirements. No. 1 steel scrap is held as high as $19, though sales have been made at $18.50; choice railroad scrap is not to be had and is quoted nominally at $23; machinery scrap $18.50; choice No. 1 yard scrap $19.50 per ton.

Pittsburg Oct. 9

Demands for deliveries on contracts in all lines of iron and steel products are more urgent this week and premiums are being freely offered. Conditions are practically the same as in 1902, and energtic efforts are being made to prevent a repetition of the disastrous termination of that boom. Advances in prices are not approved by the leading interests and premiums are

not accepted. All contracts are being taken care of as speedily as production will permit.

It was expected that some pig-iron producers would have small tonnages available during the rest of the year, but it has developed that instead many are oversold. The movement to break records of production started on Oct. 1 by the United States Steel Corporation and large independent steel concerns is being successfully carried on, and the results at the end of the month are expected to be surprising. The American Sheet and Tin-Plate Company is operating about 95 per cent. of its sheet capacity and has started the Monongahela tin works in Pittsburg, an eight-mill plant. Of its 252 tin mills all are running but 21. An accident at the Star works in Pittsburg on Saturday has caused a suspension, but it is announced that the works will be on again in a few days. The Pope tin-plate plant at Steubenville, O., the largest independent works, which has been idle for three weeks, was put in full operation yesterday.

Reports that the Carnegie Steel Company intends to discontinue a number of additional contracts for furnishing billets and sheet-bars to outsiders have been confirmed. On July 1 the company terminated several important six months' contracts and will on Jan. 1 give notices of a similar kind to other customers. Contracts that have no cancellation clause are being dropped immediately upon their termination. The United States Steel Corporation is at present operating about 97 per cent. of its blast-furnace capacity, the furnace at Niles, O., having been put in blast late last week. Some of the furnaces likely will be forced to suspend in a short time for repairs. There is an active inquiry for heavy melting scrap, but no transactions of importance have been closed since the sale last week of 20,000 tons at $17 delivered.

Pig Iron—The pig-iron market shows little change. Sales of Southern in this district aggregated 2000 tons, all Southern No. 2 foundry. The price was $17, Birmingham, for October delivery, and $16.75 for November and December shipment. There have been a number of inquiries, but it seems impossible to get any iron for delivery this year. The latest sale of bessemer was made at $19.50, Valley furnaces, and No. 2 foundry is quoted at $20.25@20.50, Valley. Gray forge has advanced to $18.65, Pittsburg, a sale of 600 tons having been made today at that price. The Westinghouse Electric and Manufacturing Company bought 1000 tons of No. 1 foundry iron for its Cleveland works, but the price was not made public.

Steel—There is no change in the condition of the billet and sheet-bar market. Bessemer billets remain nominally at $28 @29, open-hearth at $29@30 and sheet-bars at $30. Plates are unchanged at 1.60c. and merchant steel bars are still quoted by the leading interest at 1.50c., but no sales are recorded at that price.

Sheets—It is now officially declared that there will be no advance in sheets. Independent interests are taking on some new business for which they receive premiums of from $2 to $3 a ton. All the mills are behind in deliveries. Black sheets are quoted at the established price of 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferro-Manganese—There is no change in the quotations of last week and sales of 80 per cent. ferro have been made for deliveries extending through the year at $81.50@82; but it is believed a lower rate will prevail in a short time.

Cartagena, Spain Sept. 22

Iron and Manganiferous Ores—Messrs. Barrington & Holt report that there were no shipments for the week. Owing to the increased production there is considerable difficulty in procuring transport, the number of carts and donkeys being insufficient to carry the ore to the railway. Tonnage continues scarce and freight rates are somewhat firmer.

Prices are 8s. 10d.@9s. 1d. per ton for ordinary 50 per cent. ore, 9s. 4d.@9s. 7d. for special low phosphorus; 10s. 9d. for S. P. Campanil; 12s. 1d. for specular ore, 58 per cent. Manganiferous ores range from 12s. 9d. for 35 per cent. iron and 12 manganese, up to 15s. for 25 per cent. iron and 17 manganese. All prices are f.o.b. shipping port.

Pyrites—Iron pyrites, 40 per cent. iron and 43 sulphur, is quoted at 10s. 8d. per ton.

Chemicals

NEW YORK, Oct. 10

Copper Sulphate—Demand is strong and supplies are short. There is no spot material available and deliveries are being made only on contracts. Prices are nominal at $6.50 per 100 lb. for carload lots and $6.75@7 for smaller parcels.

Nitrate of Soda—The market continues strong, with an upward tendency. Messrs. Mortimer & Wisner, of New York, give the following statistics for the trade in the United States as of date Oct. 1; the figures being in long tons:

	1905.	1906.	Changes.
Stock, Jan. 1	8,380	13,100	I. 4,720
Arrivals to Oct. 1	200,000	214,680	I. 14,680
Total	208,380	227,780	I. 19,400
Deliveries, to Oct. 1	201,880	227,114	I. 25,234
Stock, Oct. 1	6,500	666	D. 5,834
Afloat, due to arrive by Jan. 15	85,400	93,700	I. 8,300

Imports are all from the west coast of South America.

Sulphur—Imports of sulphur and pyrites into the United States for the eight months ending Aug. 31 were, in tons:

	1905.	1906.	Changes.
Sulphur	58,355	62,451	I. 4,096
Pyrites	329,962	375,947	I. 45,985

Estimating sulphur contents of the pyrites, we find that the total sulphur imported this year was, approximately, 212,830 tons.

Heavy Chemicals—Imports of heavy chemicals into the United States for the eight months ending Aug. 31 were, in pounds:

	1905.	1906.	Changes.
Bleaching powder	67,464,093	70,423,368	I. 2,959,275
Potash salts	160,233,680	170,726,224	I. 10,492,544
Soda salts	18,994,328	13,686,629	D. 5,307,699

Exports of acetate of lime for the eight months were 45,378,677 lb. in 1905, and 44,156,463 lb. in 1906; a decrease of 1,222,214 lb. this year.

Phosphates—Exports of phosphates from the United States for the eight months ending Aug. 31 were 634,236 tons in 1905, and 713,289 tons in 1906; an increase of 79,053 tons. The larger exports this year were to Germany, 216,176 tons; Great Britain, 111,484; France, 88,338; Italy, 78,492 tons.

Shipments of phosphate rock through the port of Savannah for the months of August and September are reported by J. M. Lang & Co. as follows: To Germany, 13,395 tons; Holland, 8678; Italy, 1012; Great Britain, 3594; total, 26,679 tons.

Metal Market

New York, Oct. 10.

Gold and Silver Exports and Imports.

At all United States Ports in August and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Aug. 1906	$ 598,078	$7,935,928	Imp. $7,337,850
" 1905	274,153	3,213,216	" 2,939,063
Year 1906	33,512,040	80,308,039	" 46,795,999
" 1905	41,265,017	24,795,910	Exp. 16,469,107
Silver:			
Aug. 1906	4,049,173	2,738,951	" 1,310,222
" 1905	4,549,485	2,517,274	" 2,032,211
Year 1906	41,847,028	29,693,485	" 12,153,543
" 1905	33,915,751	20,666,993	" 13,248,758

These statements cover the total movement of gold and silver to and from the United States. These figures are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

Gold and Silver Movement, New York.

For week ending Oct. 6 and years from Jan. 1.

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week	.....	$5,470,234	$ 547,903	$ 49,104
1906	5,964,713	80,440,975	43,242,268	1,650,856
1905	32,291,943	5,835,360	27,028,737	3,605,561
1904	73,177,464	4,228,549	29,775,974	756,774

There were no exports of gold for the week; exports of silver were nearly all to London. The gold imported for the week came chiefly from London and Paris; the silver from Mexico and South America.

The statement of the New York banks—including all the banks represented in the Clearing House—for the week ending Oct. 6, gives the following totals.

	1905.	1906.
Loans and discounts	$1,059,740,900	$1,052,331,200
Deposits	1,059,261,700	1,031,338,700
Circulation	54,142,400	45,749,200
Specie	195,038,400	192,084,000
Legal tenders	74,063,200	75,173,800
Total reserve	$269,101,600	$267,257,800
Legal requirements	264,815,425	257,834,675
Surplus reserve	$4,286,175	$9,423,125

Changes for the week this year were increase of $1,158,400 in loans, and $153,400 in circulation; decreases of $1,243,300 in specie, $2,554,000 in legal tenders, $2,720,300 in deposits and $3,117,225 in surplus reserve.

The following table shows the specie holding, in dollars, of the leading banks of the world:

	Gold.	Silver.	Total.
New York	.....	.....	$192,084,000
England	$158,173,765	.....	158,173,765
France	567,252,905	$208,897,325	776,150,230
Germany	126,620,000	42,205,000	168,825,000
Spain	76,420,000	123,200,000	199,620,000
Netherlands	27,644,500	28,220,500	55,865,000
Belgium	16,883,335	8,346,665	25,220,000
Italy	148,235,000	18,942,500	167,177,500
Russia	553,645,000	25,415,000	579,060,000
Austria	234,040,000	59,695,000	293,735,000
Sweden	19,395,000	.....	19,395,000

The returns of the associated banks of New York are of date Oct. 6, and the others Oct. 5. The foreign bank statements are from the *Commercial and Financial Chronicle*, of New York. The New York banks do not separate gold and silver in their reports.

Exports of silver from London to the East are given by Messrs. Pixley & Abell's circular as follows, for the year to Sept. 27:

	1905.	1906.	Changes.
India	£ 4,455,321	£ 12,451,063	I. £ 7,995,742
China	758,688	430,700	D. 327,988
Straits	11,675	1,750	D. 9,925
Total	£ 5,225,684	£ 12,883,513	I. £ 7,657,829

Receipts for the week this year were £59,000 in bars and £12,000 in Mexican dollars; a total of £71,000, from New York. Exports were £163,050 in bars and £103,000 in Mexican dollars; £263,050, all to India.

The demand for Indian Exchange continues strong and all the Council bills offered in London—100 lakhs of rupees—were taken at an average of 16.06d. per rupee. The buying of silver for India has fallen off a little, owing to the high price.

The United States Mint on Oct. 3 bought 250,000 oz. silver, the price paid being 69.21c. per ounce, delivered at the Denver Mint.

The Treasury Department's estimate of the amount and kinds of money in the United States on Oct. 1 is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$273,831,835	$ 684,268,074
Gold certificates	39,882,940	541,857,929
Silver dollars	1,005,148	81,662,707
Silver certificates	4,223,690	474,338,310
Subsidiary silver	4,055,285	116,001,510
Treasury notes of 1890	22,438	6,998,562
U. S. notes	3,822,418	342,858,598
Nat. Bank notes	9,755,104	564,148,004
Total	$336,598,858	$2,812,133,694

Population of the United States, Oct. 1, 1906, estimated at 85,014,000; circulation per capita, $33.08. For redemption of outstanding certificates an exact equivalent in amount of the appropriate kinds of money is held in the Treasury, and is not included in the account of money held as assets of the Goverment. The statement of money held in the Treasury assets of the Government does not include deposits of public money in national bank depositaries to the credit of the Treasurer of the United States, amounting to $124,088,475. The amount in circulation on Oct. 1 was $45,220,395 more than on Sept. 1; and $187,903,303 more than on Oct. 1 last year.

The silver market continues decidedly steady. Inquiry from unexpected sources has diminished; supplies on London market and prices continue good.

Prices of Foreign Coins.

	Bid.	Asked.
Mexican dollars	$0.53	$0.55
Peruvian soles and Chilean	0.48½	0.51½
Victoria sovereigns	4.85½	4.87½
Twenty francs	3.87	3.91
Spanish 25 pesetas	4.78	4.80

SILVER AND STERLING EXCHANGE.

Oct.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	Oct.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
4	4.83¾	68¾	31⅞	8	4.84¼	68⅝	31 13/16
5	4.83¾	68¾	31⅞	9	4.84¼	68⅝	31⅞
6	4.83¾	68⅝	31 13/16	10	4.85	68⅝	31⅞

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Other Metals.

Daily Prices of Metals in New York.

October.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis. Cts. per lb.
4	20⅜ @20¾	20 @20½	93 13/16	42¾	5.75	6.15	6.00
5	20⅜ @20¾	20 @20½	94⅛	42½	5.75	6.15	6.00
6	20⅜ @21	20⅛ @20¾	.....	42½	5.75	6.15	6.00
8	20⅜ @21⅛	20⅛ @21	96 5/16	42¾	5.75	6.15	6.00
9	21 @21¼	20⅛ @21¼	96⅛	42¾	5.75	6.15	6.00
10	21⅛ @22	20⅜ @21½	96⅞	42½	5.75	6.15	6.00

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electrolytic copper are for cakes, ingots or wirebars. The price of cathodes is 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting & Refining Co. for near-by shipments of desilverized lead in 50-ton lots, or larger orders. The quotations on spelter are for ordinary western brands; special brands command a premium.

Copper—The improvement in the market has made further progress. Transactions, which, however, are of only moderate volume as the available supplies are getting smaller and smaller all the time, have taken place from day to day at advancing prices, and the close is very firm at 21¼@22c. for Lake copper and 20½@21½ for electrolytic in ingots, cakes and wirebars. The average for casting copper during the week was 20@20¼c., but this class of metal also closes much stronger, sales of prime brands having been made as high as 21⅛ cents.

The standard market in London has shared in the improvement in the values of the refined sorts and closes very firm at £96 17s. 6d. for spot, £96 7s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £98 10s.@£99 10s.; best selected, £101 10s.@£102; strong sheets, £106@£107.

Copper exports for the week from New York and Philadelphia were 4620 tons. Our special correspondent reports exports from Baltimore at 761 long tons.

Copper Exports and Imports—The exports of copper from the United States for the eight months ending Aug. 31 are reported as below by the Bureau of Statistics of the Department of Commerce and Labor, in long tons:

	1905.	1906.	Changes.
Great Britain	19,521	16,028	D. 3,493
Belgium	1,360	1,495	I. 135
France	21,959	24,166	I. 2,207
Italy	4,616	5,519	I. 903
Germany and Holland	70,771	78,202	I. 7,431
Russia	5,550	1,951	D. 3,599
Other Europe	7,158	7,905	I. 747
Canada	925	1,208	I. 283
China	30,824	1,602	D. 29,222
Other countries	6,755	167	D. 6,588
Total metal	169,439	138,243	D. 31,196
In ores and matte	3,887	4,356	I. 469
Total	173,326	142,599	D. 30,727

The total decrease was 17.7 per cent. If, however, we omit the exports to China in each year, the decrease is only 1505 tons, or 1.1 per cent. The actual quantities of ore and matte exported were 22,791 tons in 1905, and 32,759 tons in 1906; contents are estimated chiefly on the basis of values. Of the ore and matte this year, 23,989 tons went to Canada, 8660 tons to Mexico and 110 tons to other countries.

Imports into the United States of copper and copper material for eight months, ending Aug. 31, with re-exports of foreign metal, are reported as follows: the figures give the contents of all material in long tons of fine copper:

	Metal.	In ore, etc.	Total.
Mexico	25,644	9,629	35,273
Canada	9,876	3,188	13,064
Great Britain	6,639	.....	6,639
Japan	1,507	.....	1,507
South America	.....	1,545	1 545
Other countries	6,946	696	7,642
Total imports	50,612	15,058	65,670
Re-exports	299	57	356
Net imports	50,313	15,001	65,314
Net imports, 1905	43,269	13,451	56,720

The total increase in the net imports this year was 8594 tons, or 15.2 per cent. The actual tonnage of ores and matte from Mexico this year was 71,212; from Canada and Newfoundland, 38,818. The excess of exports over imports was 116,606 tons in 1905, and 77,285 tons in 1906; a decrease of 39,321 tons.

Copper Sheets—The base price for sheet copper, which on Sept. 20 was ad-

vanced from 23c. per lb. to 24c. per lb., on Oct. 5 was further advanced to 25c. per pound.

Tin—The market has assumed a quieter aspect, and while in London transactions at the Exchange were of fair volume, consumers in this country buy their requirements only from hand to mouth. The market closes steady at 42½ New York, and in London at £195 5s. for spot, £193 15s. for three months.

Imports of tin into the United States for the eight months ending Aug. 31 are reported as follows, in long tons of 2240 lb. each:

	1905.	1906.	Changes.
Straits	13,675	10,054	D. 3,621
Australia	363	742	I. 379
Great Britain	13,200	17,471	I. 4,271
Holland	299	347	I. 48
Other Europe	553	963	I. 410
Other countries	39	238	I. 199
Total	28,129	29,815	I. 1,686

The increase this year was only 6 per cent., notwthstanding a strong demand for the metal.

Lead—No change is to be reported in this market, which remains at 5.75 New York.

Abroad the demand has been on a very large scale, and as supplies are hardly adequate, values advanced from day to day, the close being cabled as £19 17s. 6d. for Spanish lead, £19 18s. 9d. for English lead.

Imports of lead in all forms into the United States, with re-exports of foreign metal, for the eight months ending Aug. 31, are reported as follows, in short tons:

	1905.	1906.	Changes.
Lead, metallic	3,020	10,306	I. 7,286
Lead in ores and base bullion	64,289	51,101	D. 13,188
Total imports	67,309	61,407	D. 5,902
Re-exports	43,108	32,595	D. 10,513
Net imports	24,201	28,812	I. 4,611

Of the lead imported this year, 48,401 tons were from Mexico and 5144 tons from Canada. There were 8667 tons imported from Europe. Exports of domestic lead were 203 tons in 1905, and 212 tons in 1906; an increase of nine tons.

St. Louis Lead Market—The John Wahl Commission Company telegraphs us as follows on Oct. 10: Lead is quiet, but firm. Common Missouri brands are selling at 5.82½@5.85c., while 5.95@6c. is asked for corroding lead.

Spanish Lead Market—Messrs. Barrington & Holt report from Cartagena, Spain, under date of Sept. 22, that the market is strong. Pig lead is quoted at 85.75 reales per quintal, silver being paid for at 14 reales per ounce. Exchange is 27.97 pesetas to £1. The local price of lead is equal to £17 3s. 2d. per long ton, f.o.b. Cartagena. Shipments for the week were 300 tons desilverized lead to Amsterdam, 65 tons to Marseilles.

Spelter—The market for this metal is very quiet, and transactions are of no consequence. The close is unchanged at 6c. St. Louis, 6.15 New York. The London market has shown a somewhat easier tone, and closes steady at £27 15s. for good ordinaries, £28 for specials.

Exports of spelter from the United States for the eight months ending Aug. 31 were 2040 short tons in 1905, and 3283 tons in 1906; an increase of 1243 tons. Exports of zinc dross were 1311 tons in 1905, and 9286 tons in 1906; an increase of 7975 tons. Exports of zinc ores were 18,227 tons in 1905, and 20,535 tons in 1906; an increase of 2308 tons.

Imports of spelter for the eight months were 493 short tons in 1905, and 2114 tons in 1906; an increase of 1621 tons.

Spanish Zinc Ore Market—Messrs. Barrington & Holt report from Cartagena, Spain, under date of Sept. 22, that there is no change in the market. Shipments for the week were 960 tons blende to Antwerp.

Zinc Sheets—The price of zinc sheets is $7.75 per 100 lb. (less discount of 8 per cent.) f.o.b. cars at Lasalle and Peru, in 600-lb. case for gages No. 9 to 22, both inclusive; widths from 32 to 60 in., both inclusive; the lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.5c. per 100 lb. The fluctuations in the base price for sheet zinc since Jan. 1, 1906, have been small, the highest price having been $8 on Jan. 6, the lowest $7.65 on May 18.

Antimony—A large business has developed during the past week, and spot supplies in this market have been practically cornered. There is also a good demand for futures, and prices have advanced to 23@23¾ for ordinary brands, 24½@25c. for Hallett's, 25¼@25½ for Cookson's.

Imports of antimony into the United States for the eight months ending Aug. 31 are reported as follows, in pounds:

	1905.	1906.	Changes.
Metal and regulus	3,173,135	4,793,604	I. 1,620,469
Antimony ore	1,252,829	1,168,952	D. 83,877

This is an increase of 51.1 per cent. in metal and regulus, but a decrease of 6.7 per cent. in ore.

Nickel—Quotations for large lots, New York or other parallel delivery, as made by the chief producer, are 45@50c. per lb. for large orders, according to size of order and terms. For small lots, 50@65c. is charged.

Imports of nickel ore and matte into the United States for the eight months ending Aug. 31 were 9204 tons in 1905, and 10,174 tons in 1906; an increase of 970 tons. Exports of nickel, nickel oxide and nickel matte for the eight months were 6,785,508 lb. in 1905, and 7,887,106 lb. in 1906; an increase of 1,101,598 lb. this year.

Platinum—The price continues $33 per oz. unmanufactured but $25@27 is now paid for scrap metal.

Imports of platinum into the United States for the eight months ending Aug. 31 were 4843 lb. in 1905, and 7633 lb. in 1906; an increase of 2790 lb. this year.

Quicksilver—The metal is firm and New York prices are still $41 per flask of 75 lb. for lots of 100 flasks or over, and $42 for small lots down to 10 flasks. For retail quantities, under 10 flasks, pound prices are charged, which work out to about $43 per flask. San Francisco prices are firm at $39.50 for domestic orders and $38 for export. The London price is £7 per flask, while jobbers are asking £16 18s. 9d.

Exports of quicksilver from the United States for the eight months ending Aug. 31 were 691,872 lb. in 1905, and 315,603 lb. in 1906; a decrease of 376,269 lb. this year.

Aluminum—The chief producer gives list prices for ton lots and over, as follows: No. 1, over 99 per cent. pure, 36c. per lb.; No. 2, over 90 per cent., 34c. Small lots are from 1 to 3c. higher. Granulated metal is 2c. per lb. over price of ingots; rods, 1c. per lb. over ingots. Rolled sheets are 45c. per lb. up, according to size.

Exports of aluminum from the United States for the eight months ending Aug. 31 were valued at $157,377 in 1905, and $172,813 in 1906; an increase of $15,436 this year.

Wisconsin Ore Market

PLATTEVILLE, Oct. 6

The price of 60 per cent. zinc ore remains about the same. There were a few changes in different lots depending on amount of impurities. The Baxter and Gritty Six interests sold ore on a flat bid, disregarding the usual assay bids, claiming that quicker and just as satisfactory results are obtained. The general market was characterized by inactivity, yet a great deal of ore was sold and loaded. During the week just passed, the tonnage loaded shows a healthy condition. The ore reported this week is the record in the history of Wisconsin for one week's output. The cry is still for more labor and money to push the new propositions.

The camps of the Platteville district loaded ore as follows during the week:

Camps.	Zinc, Lb.	Lead, Lb.	Sulphur, Lb.
Platteville	461,700	.....	.....
Mineral Point	525,640	.....	.....
Highland	395,920	.....	.....
Cuba City	331,615	.....	.....
Linden	276,990	.....	.....
Buncombe & Hazel Green	250,000	.....	.....
Galena	154,200	.....	.....
Dodgeville	123,000	.....	.....
Rewey	55,000	63,000	.....
Livingston	.....	.....	44,000
Total for week	2,574,025	63,000	44,000
Year to Oct. 6	58,218,921	2,700,390	3,453,910

The proposed new oxide works are expected to furnish an important local market for ore.

Missouri Ore Market

JOPLIN, Oct. 6

The highest selling price of zinc was $46 per ton, on an assay basis price ranging from $41 to $43 per ton of 60 per cent. zinc. Average price $41.10.

The highest selling price of lead ore was $82.50 per ton, medium grades bringing from $79 to $81. Average price $79.60.

See-sawing is the best word to express the system of purchasing zinc ore. Last week there was heavy purchasing in the eastern part of the district. This week the heavy purchasing was in the western part of the district, with a largely increased shipment from the mines in the Kansas and Indian Territory groups, while the Missouri groups decreased. Much of the ore loaded in the eastern portion was from purchases of the previous week, producers declining to sell on the lower offerings of this week. In the west portion offerings were not lowered. It is the old method that has been in vogue ever since mining began, of whipsawing one end of the district against the other.

Following are the shipments of zinc and lead from the various camps of the district for the week ending today:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville.	2,084,810	687,510	$ 71,281
Joplin	2,233,250	350,400	62,031
Galena-Empire	1,852,990	180,160	45,192
Duenweg	766,010	153,930	22,343
Alba	848,310	32,500	20,386
Badger	564,340	.....	12,415
Prosperity	303,970	108,440	10,700
Oronogo	379,600	.....	8,264
Neck City	316,090	14,150	7,677
Baxter Springs	382,810	.....	5,742
Spurgeon	227,550	42,930	5,031
Aurora	259,440	9,520	4,809
Sherwood	102,740	20,920	2,973
Carthage	130,200	.....	2,929
Stott City	59,480	.....	1,248
Totals	10,410,590	1,600,460	$283,041
40 weeks	423,926,250	59,899,110	$11,472,755

Zinc value, the week, $219,141; 40 weeks, $9,175,535.
Lead value, the week, 63,900; 40 weeks, 2,297,220.

The following table shows the average monthly prices of zinc and lead ores in Joplin, by months; the average for zinc being based on the prices of assay basis ores carrying 60 per cent. zinc.

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1905.	1906.	Month.	1905.	1906.
January	52.00	47.38	January	61.50	75.20
February	52.77	47.37	February	57.62	72.83
March	47.40	42.68	March	57.20	73.73
April	42.88	44.63	April	58.00	75.13
May	43.31	40.51	May	58.27	78.40
June	40.75	43.83	June	57.80	80.96
July	43.00	43.25	July	58.00	74.31
August	48.83	43.56	August	58.00	75.36
September	46.75	42.58	September	63.50	79.64
October	47.60	....	October	63.86	....
November	49.55	....	November	68.67	....
December	49.00	....	December	76.25	....

Mining Stocks

NEW YORK, Oct. 10

The public seems to be more interested in the low-priced curb stocks than in those dealt in on the Exchange and the trading in the latter was largely professional.

Steel common had an active rise from $45¾ to $49¼ on the announcement of the completion of the much talked of "ore deal." The closing price was $48½.

Amalgamated was strong all week, touching the high point on this movement. The steady advance in the price of copper metal induced large buying and the stock was buoyant all week. The closing price, $115¼, shows a net advance of $2.75 per share.

Anaconda and American Smelting common shared the advance in coppers, gaining $8¼ and $7⅜ respectively.

Federal Mining and Smelting was little dealt in, closing at $162 for the common and $96½ for the preferred.

On the curb the traders were making records. Probably more sales were recorded than in any week previous.

Little attention was paid to the par value, earning capacity or intrinsic value of the various shares, but the main idea was to be in when the next stock took a rise. Over 1,200,000 shares were dealt in and of these McKinley-Darragh led the list with 182,000. The wonderful rise in Nipissing was possibly responsible for the active trading in other Cobalt stocks.

The closing prices among the leading coppers were: British Columbia, $13⅜; Butte Coalition, 40¾; Cumberland-Ely, $13⅞; Greene Copper, $27⅞; Tennessee, $44½; and Granby, $14⅜. Nipissing mines were heavily sold and the price receded from $25, the high mark, to $21 and recovered later, closing at $22⅞ bid.

Boston Oct. 9

Copper mining shares have certainly struck their gait. Trading has been on a tremendous scale and records have been clipped in the matter of high prices. Some stocks have appreciated several dollars a share in a day and the end does not seem to be in sight. With the metal selling at present prices and money easing, there is certainly every incentive for speculation. Thus far the public has entered but mildly into the game, but it is increasing and merry times seem to be ahead.

North Butte and Butte Coalition have sort of taken a back seat on free offering of stock. The former touched $115.87½ Friday of last week, but is back to $112.50 tonight, against $105.87½ a week back. Coalition, which touched $42, fell back to $40.75 today, or the same as a week ago. Old Dominion has been the conspicuous feature in the week's trading, touching $60.50 today, a net advance of $8.50 in a week's time.

Atlantic showed a good pair of heels today, rising $5 to $17 on about 6000 shares. A report came that copper had been uncovered in the new shaft on section 16. It takes but little to kindle flame of speculation, although this, if true, is particularly important to Atlantic. Shannon continues a prime favorite and sold at its best today, $16.62½, an advance of $2.75 for the week. Osceola is up $11.50 to $130, Tamarack $13 to $110 and Quincy $13 to $108. Calumet & Hecla has $34 to its credit, selling at $839 per share today. Calumet & Arizona went up sharply to $140.50, closing at $138 tonight, against $122 a week ago. Allouez touched $42 today, against $37.50 a week back, and Centennial is up $2 to $28.75. Franklin, on the other hand, is off $2 to $23.75.

United States Smelting touched $64.37½, but receded to $62 today on the announcement that the company is going to dispose of 50,068 each of the preferred and common shares now in the treasury. This will leave 280,473 shares of preferred and 399,527 shares of common in the company's treasury. The company has spent about $4,500,000 in the purchase of new properties, etc., $1,557,000 for extensions, and the management will expend about $1,250,000 more. Net earnings for the six months ended August 31 were about $1,759,000.

The American Zinc, Lead and Smelting Company proposes to reduce its capital one-half, to 50,000 shares, par $25. There will remain in the treasury after the change 20,000 shares. One-half, or 10,000 shares, will be offered pro rata at par, $25. This will give a cash working capital of $140,000 after paying off the debt.

The curb has received its share of attention and advances equal to those of listed stocks are recorded for some. Balaklala touched $15 today and Cumberland Ely $14.50. Cananea Central reached $27 Friday and Superior & Pittsburg is up to $28.12½. Davis-Daly touched $15.50 and East Butte $13.50. The Mexico Consolidated Mining and Smelting Company has declared its second dividend of 50c. a share.

Colorado Springs Oct. 5

The local mining market has been more active than for the previous week, and several Cripple Creek stocks have had quite heavy trading. Findley has been ordered closed until the Golden Cycle mill is completed, which will no doubt be a couple of months yet. Excessive treatment charges are given as the reason. This stock declined 11c. this week. As a number of mills in the Cripple Creek district have been closed during the past month for various reasons, and many mines have held back ore for cyanide plants which are about ready for operation, the production, as reported by the operating smelters and mills, is about $300,000 less than for August. September figures are $1,449,375 in all.

San Francisco Oct. 24

Trading in the Comstocks has been a trifle better, and prices are firmer than they have been for some time. The new Nevada groups continue active, and the speculation in them exceeds anticipations. Bullfrog and Manhattan shares are special favorites. Oil stocks are looking up a little, but are still dull.

STOCK QUOTATIONS.

NEW YORK. Week Oct. 6

Name of Company.	High	Low	Clg.	Sales
Amalgamated	115¾	111½	114¾	388,770
Anaconda*	286¾	278½	281	67,790
British Col. Copper	11⅜	10⅛	11⅛	48,500
Butte Coalition*	41⅞	39⅜	40⅛	24,900
Cum. Ely Mining	14⅛	10½	13¾	52,400
Greene Gold	2⅛	1⅞	1⅞	580
Greene Gold & Silver	2⅛	1⅞	2⅛	22,975
Guanajuato	5¼	4⅞	5	4,900
Micmac	5⅛	5⅛	5⅛	7,995
Mines Co. of Am	1⅝	1⅜	1⅜	8,650
Mitchell Mining	5¼	4¾	5	15,435
Mont. Sho. Con. (New)	14¾	13	14¾	1,800
Nev. Utah M. & S.	5¼	4¾	4¾	3,700
Nipissing Mines	25	21	21⅝	207,000
Tennessee Copper	45	41½	44½	3,175
Union Copper	1¾	1	1¾	28,500
Utah Apex	7⅞	7⅞	7⅞	100

NEW YORK INDUSTRIALS.

Am. Smelting & Ref.	156	152¾	155½	51,800
Am. Smelt. & Ref., Pf.	115¾	115¾	115⅞	1,000
Bethlehem Steel	20	20	20	2,500
Colo. Fuel & Iron	57⅛	53⅝	56	57,925
Federal M. & S., Pf.*	93¾	92⅛	92½	600
Inter. Salt*	40	39	39½	4,410
National Lead	79¾	77½	77⅞	39,750
National Lead, Pf	102	101⅞	102	220
Pittsburg Coal	14⅛	14	14⅛	200
Republic I. & S.	39¼	37⅜	38¼	10,340
Republic I. & S., Pf.	99	98	99	2,500
Sloss-Sheffield	75⅝	73⅛	73¾	4,100
Tenn. C. & I.	162	155	162	1,150
U. S. Red. & Ref	36	35¾	36	400
U. S. Steel	49⅛	45¾	48¾	867,720
U. S. Steel, Pf.	108¾	106	108	91,100
Va. Car. Chem	40¼	38	39¾	2,150

BOSTON. Oct. 6.

Adventure	7¾	6½	7¾	3,705
Allouez	38½	36	38¾	3,713
Atlantic	12¾	11½	12	885
Bingham	38	34	36¾	14,725
Boston Consolidated	33	31	32½	8,675
Calumet & Arizona	140½	119⅛	140	5,142
Calumet & Hecla	827	793	827	212
Centennial	27½	26	27	5,462
Copper Range	84½	78	83	29,476
Daly-West	18	16⅜	18	972
Franklin	26	24½	24⅝	6,849
Granby	14¾	13	14⅝	5,105
Greene Consolidated	28¾	26¾	28	36,792
Isle Royal	23	20½	22½	3,390
Mass	10⅛	9	10	3,645
Michigan	17	14	16½	8,246
Mohawk	69½	63	68¾	5,186
Mont. Coal & Coke rcts.	3	2¾	3	2,525
Nevada	20¾	18	20¾	8,810
North Butte	115⅞	99¼	113¾	48,326
Old Dominion	59¾	51⅝	59¼	25,758
Osceola	126	115½	126	7,455
Parrot	29	27	28	1,680
Quincy	103	94	103	1,554
Rhode Island	5⅛	4½	5⅛	1,785
Shannon	14¾	13	14⅝	34,827
Tamarack	106	100	106	405
Tecumseh	15½	14	15	6,071
Trinity	12¾	11	11½	14,062
United Copper, com.	67	65	67	4,610
U. S. Oil	11	9½	10½	6,540
U. S. Smg. & Ref.	64¾	61¾	62¾	18,748
U. S. Smg. & Ref., pfd.	46⅛	45¾	45½	3,355
Utah Copper	68	65	68	14,316
Victoria	7½	6¾	7	3,162
Winona	12	9	11⅛	5,788
Wolverine	161	148	160	770
Wyandotte	2	1	1⅞	3,140

These stocks, not elsewhere quoted, had the following range of prices during the week: (New York) Am. Agri. Chem., 27¾—26¼; Comstock, .20; Davis-Daly Est., 15½—10; Gold Hill, 5⅜—4¾; Gugg. Exp., 295—290; Rich. Eureka, 7¼—7⅛; Standard Oil, 600—598. (Boston) Ahmeek, 88—87; Am. Zinc, 15½—15; Arcadian, 6—5¼; Ariz. Com'l, 40¼—38; Black Mt., 9½—9; Cananea, 26—21¼; Fast Butte, 12¾—10¼; Keweenaw 12—11; Majestic 2¼—2⅛; Raven, .87—.80; Shawmut, 1.00—.55; Superior Cop., 15; Superior & Pitts., 26¼—21⅝; Troy, 2⅝—2⅛.

PHILADELPHIA. Oct. 6.

Name of Company.	High	Low	Clg.	Sales.
American Cement	7	6¾	7	447
Cambria Steel	38¾	38	38⅝	5,323
General Asphalt	8¼	7⅜	7⅛	32
Penn. Steel, pd	106½	106⅜	106½	312
Philadelphia Co.	49½	49	49½	227
Tonopah Mining	20	18½	19⅞	5,299

PITTSBURG. Oct. 6.

Crucible Steel	13	11¾	18	1,142
Crucible Steel, Pf.	79⅞	78⅛	79¾	1,412
Harbison-Walker Ref.	13¾	13½	13⅞	75
Ohio Tonopah	.25	.25	.25	300
Tonopah Ext	5¾	5	5¼	4,055

COLORADO SPRINGS. Oct. 6.

Name of Company.	High	Low	Clg	Sales
Acacia	13	12¾	12⅞	3,000
Dante	5½	5	5	....
C. C. Con	6¾	6¼	6½	....
Doctor Jack Pot	8¾	8¾	8¾	....
Elkton	51	49½	51	20,600
El Paso	53	50¾	50¾	7,600
Findley	71	60	60	13,500
Gold Dollar	8¼	8	8¼	8,000
Gold Sovereign	6⅝	6¼	6½	....
Isabella	22	19½	22	7,600
Jennie Sample	9¾	9	9¼	....
Mary McKinney	67	66	66	8,000
Portland	1.35	1.32	1.35	1,400
United Gold Mines	12	11	12	....
Vindicator	95	94	94	....
Work	18¾	17	18¾	....

SAN FRANCISCO. Oct. 4.

Name of Company.	High	Low	Clg	Sales
Best & Belcher	.90	.84	.87	1,250
Caledonia	.38	.36	.38	2,200
Challar	.12	.10	.11	4,250
Con. Cal. & Va	.84	.75	.83	2,950
Crown Point	.08	.07	.08	800
Gould & Curry	.22	.17	.20	3,600
Hale & Norcross	1.10	.90	1.10	1,500
Mexican	.73	.66	.73	3,900
Ophir	2.80	2.40	2.80	3,730
Overman	.12	.09	.12	2,700
Potosi	.14	.12	.12	1,400
Savage	1.20	1.10	1.20	3,200
Sierra Nevada	.43	.28	.41	11,700
Bullfrog Mining	.51	.46	.46	21,800
Diamondfield B B. Con.	.36	.34	.35	12,325
Goldfield of Nevada	.65	.59	.59	12,900
Jim Butler	1.40	1.30	1.35	25,484
Jumping Jack	.57	.54	.56	45,400
Kendall	.61	.55	.55	1,100
MacNamara	.89	.82	.85	34,000
Manhattan Dexter	.65	.52	.54	6,500
North Star	.47	.46	.47	3,700
Original Bullfrog	.16	.13	.15	71,300
Tonopah Belmont	6.60	5.62½	6.60	3 150

Tonopah Stocks. Oct. 10.

(Revised by Weir Bros. & Co., New York.)

	High.	Low.	Last.
Tonopah Mine of Nevada	20 25	20.00	20.25
Tonopah Montana	3.18	3.05	3.16
Tonopah Extension	5.62½	5.37½	5.62½
Tonopah Midway	2.12	2.08	2.10
Tonopah West End	2.70	2.60	2.65
Goldfield Mining Co.	.61	.59	.60
Jumbo Mining	1.48	1.44	1.47
Red Top	1.52	1.47	1.48
Sandstorm	.70	.66	.68
Montgomery Shoshone Cons	18.00	16.00	17.00

St. Louis. Oct. 6.

Adams, $0.40 — $0.25; American Nettie, $0.08—$0.06; Center Creek, $2.50—$2.25; Central Coal and Coke, $64.50—$62.75; Central Coal and Coke, pfd., $80.00—$79.00; Central Oil, $60 00—$55.00; Columbia, $4 00—$3.90; Con. Coal, $22.00—20.50; Doe Run, $130.00—$125.00; Granite Bimetallic, $0.22—$0.20; St. Joe, $13.00—$12.00.

LONDON. *(By Cable.*)* Oct. 10.

Dolores, £1 17s. 6d.; Stratton's Independence, £0 3s. 9d.; Camp Bird, £1 6s. 9d.; Esperanza, £3 5s. 0d.; Tomboy, £1 8s. 1½d.; El Oro, £1 7s. 6d.; Oroville, £1 2s. 0d.; Somera, £0 6s. 10½d.; Utah Apex, £1 15s. 0d.; Ariz. Copper, pref., £3 12s. 6d.; Ariz. Copper, def., £3 11s. 3d.

New Dividends.

Company.	Payable.	Rate.	Amt.
Bunker Hill & Sullivan	Oct. 4	$0.60	$180,000
Frances-Mohawk, Nev.	Oct. 6	0.05	50,000
Guanajuato Con.	Oct. 31	0.07½	45,000
Harbison-Walker Ref., pfd.	Oct. 20	1.50	144,000
International Nickel, pfd.	Nov. 1	1.50	131 123
Nipissing Mines	Oct. 20	0.25	300,000
Philadelphia Co.	Nov. 1	0.75	443,296
Snowstorm, Idaho	.....	0.06	90,000
Standard Con., Cal.	Oct. 15	0.15	26,759
Tenn. Coal, Iron & R. R.	Nov. 1	1.00	225,536
Tonopah of Nev.	Oct. 20	0.35	350,000
United Copper, com	Oct. 31	1.75	787,500

Assessments.

Company.	Delinq.	Sale.	Amt.
Bonanza Con., Utah	Oct. 8	Oct. 25	$0.01
Deer Trail	Sept. 22	Oct. 22	0.01
Exchequer, Nev.	Nov. 2	Nov. 22	0.05
Mexican, Nev.	Oct. 16	Nov. 5	0 15
Naildriver, Utah	Oct. 10	Oct. 30	0.03

Monthly Average Prices of Metals.

SILVER.

Month.	New York. 1905.	New York. 1906.	London. 1905.	London. 1906.
January	60.690	65.288	27.930	30.113
February	61.023	66.108	28.047	30.464
March	58.046	64.597	26.794	29.854
April	56.600	64.765	26.108	29.984
May	57.832	66.976	26.664	30.968
June	58.428	65.394	26.910	30.185
July	58.915	65.105	27.163	30.113
August	60.259	65.949	27.822	30.529
September	61.695	67.927	28.528	31.483
October	62.034	.....	28.637	.....
November	63.849	.....	29.493	.....
December	64.850	.....	29.977	.....
Year	60.352	.....	27.839	.....

The New York prices are in cents per fine ounces; the London quotation is in pence per standard ounce, 0.925 fine.

COPPER.

	New York. Electrolytic. 1905.	New York. Electrolytic. 1906.	New York. Lake. 1905.	New York. Lake. 1906.	London. 1905.	London. 1906.
Jan	15.008	18.310	15.128	18 419	68.262	78.896
Feb	15.011	17.869	15 136	18.116	67.963	78.147
March	15.125	18.361	15.250	18.641	68.174	81.111
April	14.920	18.375	15.045	18 688	67.017	84.793
May	14.627	18.457	14.820	18.724	64.875	84.867
June	14.673	18.442	14.813	18.719	65.881	83.994
July	14.888	18.190	15.065	18.585	66.887	81.167
Aug	15.664	18.380	15.725	18.706	69.830	83.864
Sept	15.965	19.033	15.978	19.328	69.667	87.831
Oct	16.279	.....	16.332	.....	71.406	.....
Nov	16.599	.....	16.758	.....	74.727	.....
Dec	18.328	.....	18.398	.....	78.993	.....
Year	15.590	.....	15.699	.....	69.465	.....

New York prices are in cents per pound. Electrolytic quotations are for cakes, ingots or wire bars. The London prices are in pounds sterling, per long ton of 2240 lb., standard copper.

TIN IN NEW YORK.

Month.	1905.	1906.	Month.	1905.	1906.
Jan	29.325	36.390	July	31.760	37.275
Feb	29.262	36.403	August	32.866	40.606
March	29.523	36.662	Sept	32.095	40.516
April	30.525	38.900	Oct	32.481	.....
May	30.049	43.313	Nov	33.443	.....
June	30.329	39.260	Dec	35.835	.....
			Av. year.	31.358	.....

Prices are in cents per pound.

LEAD IN NEW YORK.

Month.	1905.	1906.	Month.	1905.	1906.
Jan	4.552	5.600	July	4.524	5.750
Feb	4.450	5.464	Aug	4.665	5.750
March	4.470	5.350	Sept	4.850	5.750
April	4.500	5.404	Oct	4.850	.....
May	4.500	5.685	Nov	5.200	.....
June	4.500	5.750	Dec	5.422	.....
			Av., year.	4.707	.....

Prices are in cents per pound. The London average for January, 1906, was £16,850 per long ton; February, £16,031; March, £15,922; April, £15,959; May, £16,725; June, £16,813; July, £16,525; August, £17,109; September, £18,266.

SPELTER.

Month.	New York. 1905.	New York. 1906.	St. Louis. 1905.	St. Louis. 1906.	London. 1905.	London. 1906.
Jan	6.190	6.487	6.032	6.337	25.062	28.225
Feb	6.139	6.075	5.989	5.924	24.594	25.844
Mar	6.067	6.209	5.917	6.056	23.825	24.563
April	5.817	6.078	5.667	5.931	23.813	25.781
May	5.434	5.997	5.284	5.846	23.594	27.000
June	5.190	6.096	5.040	5 948	23.875	27.728
July	5.396	6.006	5.247	5.856	23 938	26.800
Aug	5.706	6.027	5.556	5.878	24.675	26.938
Sept	5.887	6.216	5.737	6.056	26.375	27.563
Oct	6.087	.....	5.934	.....	28.225	.....
Nov	6.145	.....	5.984	.....	28.500	.....
Dec	6.522	.....	6.374	.....	28.719	.....
Year	5.822	.....	5.730	.....	25.433	.....

New York and St. Louis prices are in cents per pound. The London prices are in pounds sterling per long ton (2240 lb.) good ordinary brands.